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ATOMIC PHYSICS AND INTERNATIONAL COOPERATION

NIELS H. D. BOHR

Professor of Theoretical Physics, University of Copenhagen

(Read October 21, 1946, in Philadelphia in the Symposium of the National Academy of Sciences on Present Trends and International Implications of Science)

AFTER expressing on behalf of the Danish delegates gratitude towards the American Philosophical Society and the National Academy of Sciences for the generous invitation to participate in this international gathering devoted to the prospects of cooperation in science, which offers such great opportunites not only for advancement of knowledge but also for promotion of understanding between peoples, the speaker opened the discussions of the special problems created by the recent development of atomic physics with some general remarks the essence of which is given in the following abstract.[1]

As an introduction to the subject, stress was laid on the decisive part international cooperation has played in creating, in the course of comparatively few years, a whole new branch of science which, at the same time as it has to such a high degree deepened our insight in the phenomena of nature, has led to practical consequences of immense implication for the future of civilization, calling for a thorough revision of our attitude to the whole question of international relationship.

The fundamental discoveries of the constituents of the atom and the quantum of action, which were the outset of the development, originated, as is well known, in lines of inquiry pursued in various countries by scientific schools with different traditions and outlooks, the confluence of which gave rise to international cooperation of an intensity and enthusiasm which has indeed only few counterparts in the history of science. This cooperation proved ever more fruitful in the last decades, where the interpretation of the ordinary physical and chemical properties of the elements, based on specific ideas of atomic constitution, reached such a remarkable level of consistency and completion and where, at the same time, studies of the transformations of the very nucleus of the atom opened the quite new field of research which was to bear such great consequences.

Moreover, this development has established, in increasing measure, close contact between many domains of science in which natural phenomena have been approached from different starting points and attacked by different methods. Not only have physics and chemistry become intimately amalgamated on a common basis, but the tools created by atomic research have proved most powerful in wide fields of technology and biology. It need, thus, hardly be stressed how great are the new possibilities which have been opened for the most purposeful applications of the properties of matter and for the refinement of the studies of the structure of organisms and the metabolic processes connected with the upholding of life. The latest progress, which entails such great promise as regards new energy sources for industry, opens also prospects for the medical sciences which can hardly be overestimated.

Indeed, the whole development should offer immense opportunities for a world-wide collaboration on the advance of science and the promotion of human welfare, but all such perspectives may be overshadowed by deadly menaces to civilization, unless in due time universal agreement be obtained about proper measures to avert misuse of the formidable power of destruction which has come into the hand of man. Such measures will obviously demand sacrifices of accustomed national prerogatives and abolition of barriers hitherto considered necessary to safeguard national interests, but now standing in the way of common security against unprecedented dangers. In removing obstacles to mutual confidence, an agreement on this vital matter should certainly go far in furthering a harmonious relationship between nations.

The achievement of the great goal which places the gravest responsibility upon our generation will, of course, demand the good will of all peoples and, in this respect, important services may be rendered by scientists in every country, not only in their capacity as advisers to the responsible govern-

[1] Reference may also be made to some previous articles of the writer: Biology and atomic physics (Reports of the Galvani Congress), *Il Nuovo Cemento* n.s. **15**: 429–438, 1938; Natural philosophy and human cultures, *Nature* **143**: 268, 1939; Science and civilization, *The Times*, August 11, 1945 (reprinted in *One world or none* ed. by D. Masters and K. Way, New York, Whittlesey, 1946); A challenge to civilization, *Science* **102**: 363, 1945.

ments but also by bringing about a proper public appreciation of the situation, just as it is to be hoped that the intimate bonds between scientists of various nations, created by years of close intercourse, may prove to be of essential help.

The circumstance that we have to do with implications of scientific studies, undertaken with no other aim than to widen the borders of our knowledge and to deepen our understanding of that nature of which we ourselves are a part, should present the best background imaginable for meeting the exigencies of the situation in the proper spirit and, in this respect, it is perhaps not unimportant that the very philosophical lesson impressed upon us by the development of physics in our generation is especially suited to further common human understanding.

In fact, again and again we have been confronted with experiences which in an unforeseen way have revealed limitations of customary ideas and demanded a revision of the foundation of our whole conceptual frame. Just as the recognition of general relativity, which has lent such unity to our picture of the universe, has strikingly illuminated the extent to which the presentation of any event depends on the standpoint of the observer, so has the elucidation of the apparent paradoxes which were encountered in the exploration of the world of atoms disclosed further presumptions for the interpretation of observations and reminded us of fundamental aspects as regards analysis and synthesis of experience.

The impossibility of making a sharp distinction between an independent behavior of the objects and their interaction with the measuring agencies entails, thus, a limitation as regards the analysis of individual atomic processes incompatible with accustomed demands of explanation. In particular, phenomena observed under different experimental arrangements cannot be directly compared, but must be regarded as complementary in the sense that only together do they exhaust all obtainable knowledge regarding the objects. In offering a frame wide enough to allow a harmonious synthesis of the peculiar regularities of atomic phenomena, the conception of complementarity may be regarded as a rational generalization of the very ideal of causality.

New as this way of description is in physical science, it is nevertheless familiar in other fields of knowledge. Thus, in biology we meet with suggestive analogies in the opposite points of view of mechanistic and vitalistic argumentation, and especially in psychological studies are we presented with problems which, in epistemological respects, exhibit a close analogy to the intricacies of atomic physics. Thus, in introspection we have always to do with an arbitrary separation between the object of conscious analysis and the subjective background for the judgment, and it is essential to recognize how intimately the choice of this separation depends on those aspects of psychological experience to which attention in the given situation is directed.

In fact, the latitude for all feeling of volition is afforded by the very circumstance that the situations in which we can speak of freedom of will are mutually exclusive to those where causal analysis of mental phenomena can reasonably be attempted. Likewise, the background for all deeper religious attitude is the more or less intuitive recognition of the complementary relation between situations where such words as love or justice can be unambiguously applied. Indeed, we are here reminded of the old wisdom that, in searching for harmony, we must never forget that we are as well actors as spectators in the great drama of existence.

As regards that education in mutual understanding which at present is more necessary than ever, it should also be remembered that the comparison between different human cultures besides obvious relative features discloses typical complementary relationships. Not merely are we here presented with such contrasting pictures as meet observers attempting from different standpoints to describe the behavior of physical objects in terms of well established general concepts, but the very background for the attitude of different peoples to the various sides of life is engendered by traditions which have deep roots in historical developments. A full mutual appreciation of the cultural achievements of humanity is indeed irreconcilable with the complacency inherent in any national culture.

An apology for entering on these general topics in connection with the acute problems facing the world today may perhaps be found in the circumstance that the pursuit of knowledge in a domain of science as remote from human passions as the study of the most elementary physical phenomena has not only forcefully impressed upon us how necessary is openness of mind for the search of truth, but also suggestively reminded us of the common basis of all endeavors for the elevation of human culture. Surely, this circumstance should prove helpful for the strengthening of that spirit which now is incumbent if mankind shall be able jointly to reap the fruits which the progress of science offers.

AN ELECTRONIC READING AID FOR THE BLIND

V. K. ZWORYKIN AND L. E. FLORY

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(*Read October 19, 1946*)

TODAY, perhaps more than ever before, we are made aware of the plight of the handicapped. Many veterans of the recent war are returning bearing the marks of battle. Skillfully made artificial limbs enable many handicapped to lead nearly normal lives and plastic surgery may obliterate disfigurement. The blind, however, have no such assistance and it is necessary for them to substitute some of the other senses for lost eyesight, or to rely on another being for the information their eyes should receive. Perhaps the greatest loss to a blinded person is the inability to read. Of course an ever increasing amount of material is being made available in Braille and in the talking book but the scope is still limited and the reader must rely on the selection made by someone else. The time required for transcription and the expense involved eliminate any possibility of newspapers, many magazines, typewritten letters, etc., being available directly to the blind. Therefore, there is great need for some device which would enable the blind to read directly ordinary printed matter.

The idea is not new. As early as 1914 Fournier d'Albe had devised a machine which he called the Optophone for reading print. This device divided the print into five zones. Along a vertical line were placed five spots of light, one in each zone, each spot being modulated at a different frequency. The reflected light was picked up by selenium cells and by means of a bridge circuit was made to produce a sound only when one or more of the spots rested on the black print. Thus, as the line of light spots was moved along the lines of print, tones or chords would be produced varying with the character of the letter.

This system, while operative, had several limitations. The production of five separately modulated light spots in the small space available introduced difficult mechanical problems. The alignment of the spots with the type was critical and accommodation of different type sizes was difficult.

From the Fournier d'Albe experience and preliminary tests made in our laboratory, several requirements were set up which we believe an eventually successful reading device must meet.

First it must have a small, preferably hand held, stylus for scanning the type.

Second, the alignment with the type must be tolerable to such an extent as to make necessary only the simplest, if any, guides or mechanical aids.

Third, the instrument should accommodate different type sizes with a simple adjustment.

Lastly, the instrument should, of course, give the most distinctive and easily learnable signal possible.

There are two approaches to the problem of reading by auditory methods. One is word recognition as is used in ordinary speech and reading, and the other is letter recognition. For high reading speeds word recognition is essential, but simple tests of reading aloud by pronouncing each letter indicate that the limit of reading speed by letter recognition would be in excess of sixty words per minute. In addition, the brain has an integrating effect so that at higher speeds word patterns are recognized. This is nicely shown in Morse Code where word recognition is used at higher speeds although the letter signals are intact.

DESCRIPTION OF EQUIPMENT

In the present device, which is essentially a letter recognition device, since complete individual letter identification is possible, a small spot of light is caused to move up and down in a regular manner along a vertical line a little more than letter height. In synchronism with the motion of the light spot, an audio oscillator is frequency modulated so that when the spot is at the top of the letter the frequency is high, and when the spot is at the bottom the frequency is low. The light reflected from the page is picked up by a phototube, the signal from which is used to operate an amplifier allowing the audio frequency to reach the reader's ear only when the spot is on a black part of the letter. The frequency of the tone heard will depend on the vertical position of the black area upon which the spot falls. As the stylus is then moved manually along the lines of print audible information is obtained as to the number, size, and position of

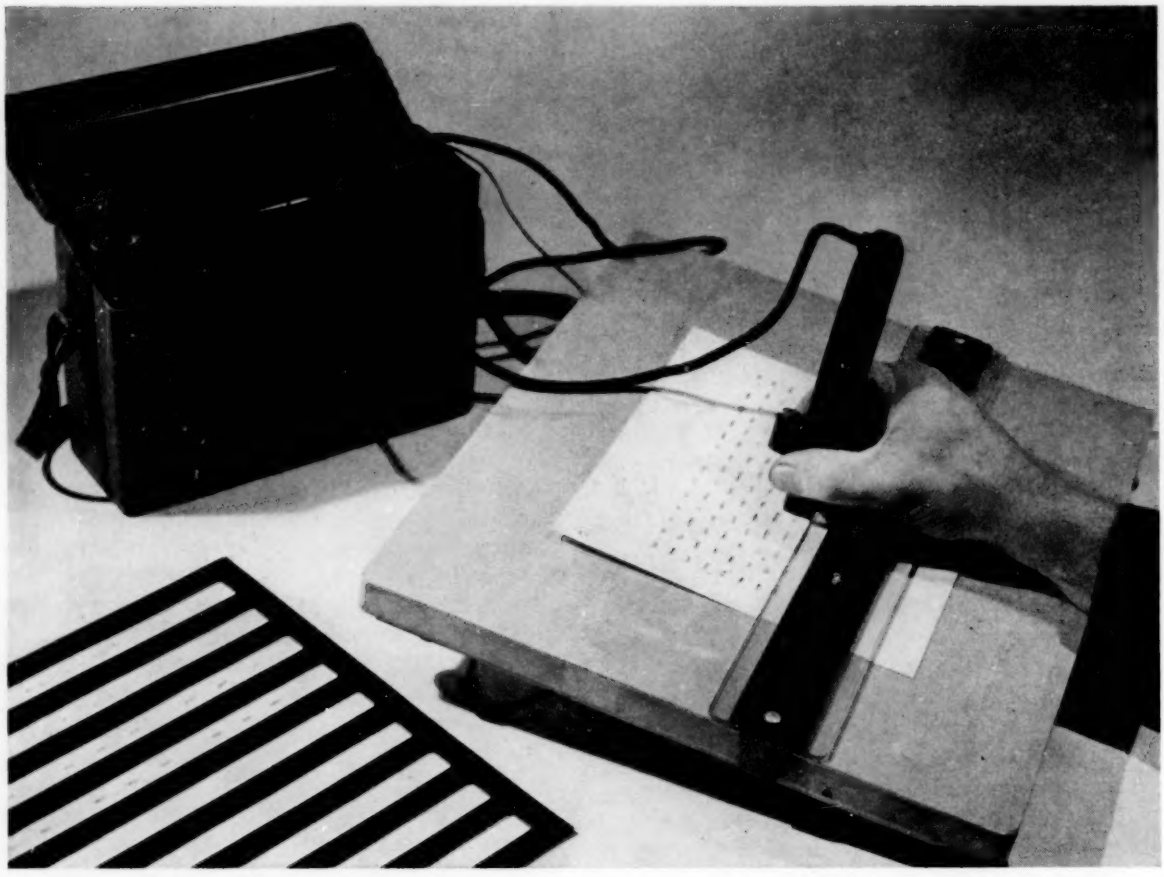

FIG. 1. The reading aid in use.

black areas being scanned. The variations in these sounds as the letters and words move under the stylus make up the signal applied to the ear.

The instrument is shown in use in figure 1. As can be seen, it is composed of two parts, the stylus which is hand held and a small case containing the batteries and associated circuits. The total weight is five pounds.

The signal is generated by conventional beat frequency methods, the two oscillators operating at about 50 kilocycles. A pentagrid converter stage is used as a mixer and at the same time acts as a valve to pass the audio frequency in response to the signal from the stylus. The frequency of one of the oscillators is varied by means of a special vibrator arrangement. An automobile radio type vibrator was altered so as to operate at a lower frequency, and in addition has attached to its reed a powdered iron armature. The vibrator is so mounted that this armature is part of the magnetic circuit of the inductance of the variable frequency oscillator. Thus, as the reed vibrates, the motion of the armature causes the reluctance of the magnetic path to vary, thereby varying the inductance and finally the frequency of the oscillator. The audio frequency is varied between 300 and 4,000 cycles and the scanning rate is 30 per second.

The stylus contains a light source and projec-

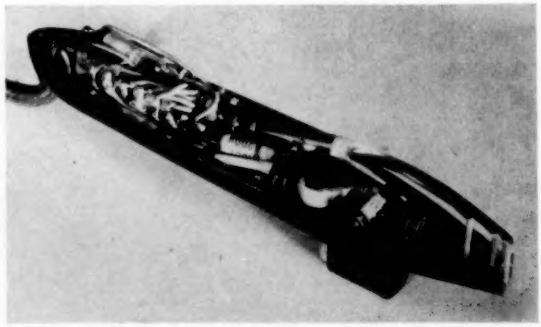

FIG. 2. Stylus with cover removed showing interior.

tion system including a vibrating mirror for producing the motion of the spot, light collecting means, and a phototube with two stage amplifier. The interior of the stylus is shown in figure 2. The scanner assembly and light collector removed from the stylus are shown in figure 3. Light is provided by a small aircraft indicator lamp enclosed in the housing *A*. The 45° mirror *M* and the lens *L* combine to project an image of the filament in the plane of the paper. The mirror *M* is mounted on a magnetized armature which is caused to vibrate by a current flowing in the coil *C*. This vibration causes the light spot to move in a line to scan the print in a vertical direction. The coil is excited by the voltage across the main vibrator coil in the case. A variable resistor in series with the scanning coil is used to adjust the scanning amplitude to fit the print being read. The light reflected from the paper is collected by the lucite light conductor *B* and carried to the miniature phototube *P*. The output of the phototube is amplified by a two stage hearing aid type tube followed by an additional stage in the case. A block diagram of the equipment is shown in figure 4 and a schematic in figure 5.

The filaments, lamp, and vibrator operate from a small storage cell giving 10 to 12 hours life after which it must be recharged. The plate voltage is supplied by a hearing aid type B battery. The batteries are so arranged that they may be easily changed by the blind, all connections being made automatically by closing the tray at the top of the instrument.

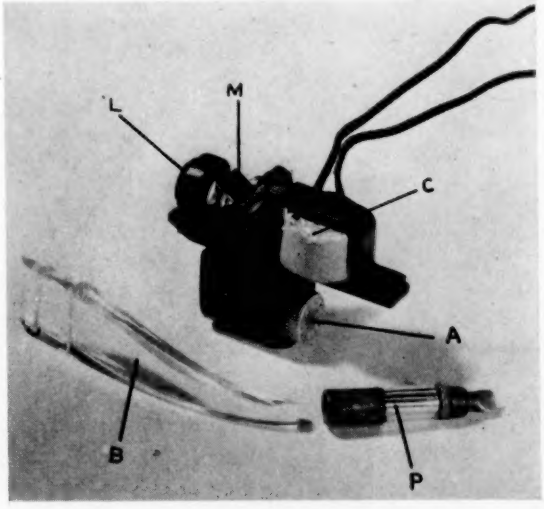

FIG. 3. Scanning and light collecting elements removed from stylus.

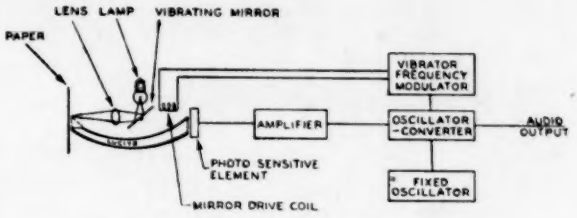

FIG. 4. Block diagram of instrument.

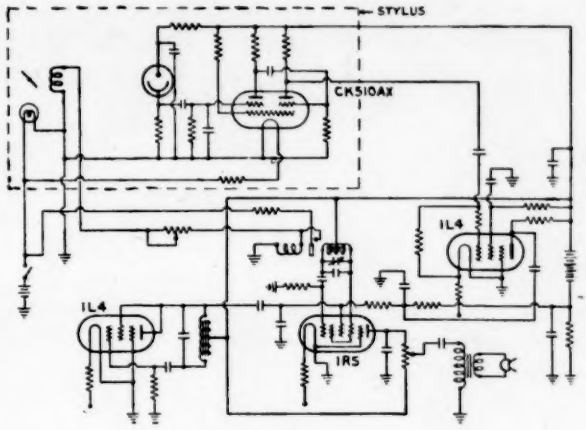

FIG. 5. Schematic diagram of electrical circuit.

In operation the stylus is hand held as was shown in figure 1. Up to the present time some form of guide as shown has been used but it is hoped that a proficient reader will be able to dispense with any mechanical aids since any wandering from the line will be indicated by a change in pitch of the signal before the deviation is sufficient to cause loss of letter identity. This is made possible by slightly overscanning the letter, which permits some tolerance in the position of the scanning relative to the print without losing any of the information concerning the letter. The pitch of the signal, however, changes with the position of the letter along the scanning line, giving the necessary clue when the stylus wanders from the line.

As was pointed out earlier, the instrument gives complete information as to the number, extent, and location of black areas as they pass under the stylus. Thus, it is possible to reproduce complete letters from the signal produced by the instrument. This has been done in figure 6. The motions of the light spot and of the stylus were synchronized with the sweeps of an oscilloscope while the output of the instrument was used to modulate the oscilloscope beam. This gives a check on the accuracy of the information provided.

The equipment described is not presented as

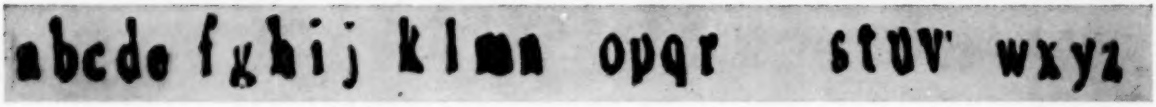

FIG. 6. Oscillogram of signal from reading aid.

the ultimate solution to the reading problem and it is not considered ready for general use. It has, however, given some interesting results. The signal produced has proved to be learnable and the stylus can be manipulated by hand with a minimum of mechanical aid.

READING TESTS

The problem of evaluating a device such as the Reading Aid is not simple. All tests must, of course, be subjective and there is no previous work to rely upon. In looking for past experiences which might serve as a guide, the nearest approach to the type of information supplied by this instrument seemed to be the continental Morse Code. Therefore, the teaching methods to date have more-or-less followed experience gained with code.

The letters were first arranged in groups simply in their usual order and later in random fashion. After a few hours practice, the letters begin to arrange themselves into groups depending upon their similarity to other letters. One heterogeneous group l, w, m, d, p, q and g are learned quickly. Letters b, h and k are learned quickly as a group but are extremely hard to identify with respect to each other without the aid of contextual clues. The same is true of a, c, and e. The other letters are of varying degrees of difficulty but are learnable.

Two subjects, both blind, have been working on the problem for some time with approximately parallel results.

After about sixty hours study in each case, the readers were able to identify letters at random with about 80 per cent accuracy. A large part of the 20 per cent error was due to the difficulty with the b, h, and k group; the a, c, and e group and to some difficulty with t and r being confused with c.

At the sixty-hour point the subjects began to identify words and soon after to read simple sentences. Many simple words are recognized without spelling and familiar groups of letters in more complex words are recognized as units.

After about one hundred fifty hours, reading speeds on simple material have reached a value of about fifteen words per minute. This of course is not considered a practical reading speed, and the time required for learning is quite high. Therefore, work is in progress on another approach to the problem; namely, that of complete electrical letter identification. Once each letter can be made to produce a signal which can be identified by electrical means, that signal can then be used to control a locally generated sound of any character. In this way the difficulty due to similarity between letters can be eliminated and the device made to produce more phonetic sounds which will be much easier to learn.

The work on this project is sponsored by the Committee on Sensory Devices of the National Research Council under the chairmanship of Dr. George W. Corner.

The authors wish also to express appreciation to the two blind subjects, Miss Annette Dinsmore and Mr. Joseph Piechowski, who have spent long hours in learning to use the equipment.

AMERICAN DEMOCRACY AND THE CIVIL WAR

ROY F. NICHOLS

Professor of History, University of Pennsylvania

(*Read October 19, 1946*)

I

THE United States has always been a laboratory and experiment station for political scientists, of both amateur and professional standing. Its research program has been the invention and perfection of mechanisms of self-government, designed to enable a growing society to enjoy liberty, equality, and unlimited opportunity, and at the same time to maintain a reasonable amount of order. The output of this laboratory has been of constant interest to the many observers who have been particularly concerned with the inventions in federalism designed to enable democracy to operate.

The history of some of these experiments is of particular moment today, when mankind is struggling with the great political problem of world federalism. The current effort to create the United Nations is the center of universal attention, for the dangers which confront humanity make this an experiment which may be crucial. The nature of American experience therefore should be an object of careful study and no incident more so than the Civil War of 1861–1865, for it clearly demonstrated certain federal weaknesses, weaknesses that contemporary architects of federalism should carefully seek to avoid.

Unfortunately historians have had a difficult task in discovering the truth about the Civil War and in interpreting its causes and its significance. So much of the record is clouded by obscurantism, made the murkier by nationalistic and patriotic folk interpretations and traditions, which are among the most difficult classes of evidence with which the historian has to deal. In every nation's history the spokesmen of the populace make up a canon of historical interpretation as crises occur. Also a vested interest often appears shortly after such cataclysms and devotes much energy to establishing an interpretation which is generally too simple to have much validity for the scientific scholar of later day. Such interpretations pose a difficult problem to all students of political experience, a problem which is of interest to anyone concerned with the use of evidence.

During the Civil War, Lincoln and his associates made superb statements of the causes and purposes of the conflict as they saw them with their contemporary northern vision. Their official version was that a righteous and indignant people was struggling to prevent the destruction of the Union by a group of ardent, misguided secessionists who sought to break up the American political experiment because they feared—quite mistakenly and willfully—that their civilization was in danger. A more radical faction of Lincoln's party added that the war was fought to destroy the curse of slavery. The Republican party, the G.A.R., school-book writers, and historians in general wove these two purposes into a composite and repeated them frequently enough to make them traditional. The military and political phases of the war attracted attention, especially as the generals and politicos fought it over again in their memoirs. For years the scholars spent their time in working out such details, discussing political issues and military strategy, and endeavoring to solve "scientifically" the controversies over reputation.

Just about the time when, under the old rules, historians would have begun to be really concerned with questioning tradition, namely about two generations after the event, the problem of the discovery of the truth was further complicated. A Southern interpretation emerged which was the more convincing because it seemed to be "scientific." I refer to the Southern reinterpretation which has been appearing in monographs, articles, and comprehensive works during the last fifteen years, and has been no mean part of a Southern renaissance.

The essence of this analysis is that cultured, civilized people were driven to fight in order to protect their superior institutions from attacks which a swiftly growing industrialized northern capitalism was directing against them in the name of liberty, hypocritically denouncing Negro slavery while itself creating a wage slavery more inhumane and degrading. According to this theory, the Southern "cause" was "lost" because borne

down by the weight of superior numbers and resources; and the implication is that this defeat destroyed the best possible effective check on the oligarchic power of industrial capitalism. Further it is maintained that Negro slavery had reached its natural limits and had the North been better mannered, less grasping, abusive, and hypocritical there would have been no war. The fault lay north of the Mason-Dixon line.

This thesis has won such wide acceptance that one historian has declared "in song and story it is the South that has won the decision at Appomattox." Another, much concerned at this, believes that these "revisionist dogmas are carrying historians further from an explanation year by year." [1]

This later type of interpretation has been made by very able scholars, trained in the best graduate schools, several of them born in the North and most of them educated there. They have been activated by that great and worthy ambition of modern scholarship to correct ancient errors, discover new truth, and perchance to hang the scalp of a "find" on the belt of the scholar. Nevertheless, the result is a "scientific" blessing of a folk-legend long current in the land where the "Lost Cause" has never been forgotten.

Despite the obfuscations of these nationalistic folklore interpretations, efforts have not been lacking to produce a more objective explanation. Much research and writing have brought to light new data, particularly regarding social and cultural factors. The war has been described as a contest between economic interests, namely the agrarian South and the industrialized North; or as a clash between cultures when the people of the sections living in different physiographic environments developed separate ways of life and patterns of thought. Psychological complexes and antagonisms have been emphasized in line with recent interest in psychiatry.[2]

Much of the work represents a retreat from political interpretation. Such a broadening of the base of analysis was desirable; there had been too great a preoccupation with the political. But the pendulum has swung too far in the other direction and has left an unfortunate blind spot. For political behavior is an important and often decisive factor in a cultural interpretation of history, particularly among a people so politically minded as the inhabitants of this Republic. It should be remembered that the various economic, social, and psychological factors, which figure so largely in more recent theories of causation applied to the Civil War, have existed elsewhere without causing wars. Why did they do so here? What was the peculiar catalytic agent in the United States? I am about to maintain that it is found in the nature of our political behavior.[3]

II

When the Founding Fathers met, next door in Independence Hall, to create the United States of America they were remarkably wise but at the same time much limited by the narrow bounds of contemporary social knowledge. Their political wisdom moved them to prescribe a federal system, rather than to attempt to force the establishment of a centralized national government. They failed, however, to foresee how the processes of national growth were to affect their handiwork. They created a system without sufficient mechanism to operate it. Their successors, without their wisdom or purposefulness, had to create this machinery.

The crux of the problem of government, for which machinery was necessary, presented by the federal system in operation, was the method of registering the popular will. All laws, all executive acts, all judicial determination were to be made by representatives of the people, or their appointees. How were these representatives to be chosen?

The makers of the Constitution were used to a state system of elections which was the product of colonial custom and experience rather than the result of comprehensive planning. In the main the drafters accepted these electoral customs and added but little to them. The two popularly-elected groups, the members of the lower house of the Federal Congress, and that part of the Electoral College chosen by direct vote rather than by state legislatures, were to be selected at such times and by such voters as the states might prescribe. The only federal requirement was that the Congressmen must be chosen in time to assemble on the first Monday in December of the odd years, and the Presidential electors so that they could meet in their respective state capitols in the December of every leap year. The result was that from the beginning each state determined its own times and seasons and as late as 1861 there had been

[1] De Voto, Bernard, The easy chair, *Harper's Magazine* **192**: 126, 124, Feb. 1946.

[2] Beale, Howard K., What historians have said about the causes of the Civil War, *Soc. Sci. Res. Coun. Bull.* **54**: 53–102, 1946.

[3] This subject is treated at length in Roy F. Nichols, *The disruption of the American democracy* which is in press.

little progress on the road to uniformity among the then thirty-four states. State and Congressional elections were held here and there in all months of every year, save January, February, June, and July. Election activity was never ending.

A second mechanism for registering the popular will—the system of parties—was not envisioned by the gentlemen next door when they did their work in 1787, nor did it emerge quickly, as historians generally assume. Machine politics was of slow growth and developed only after a phenomenal increase in the population. Political leaders in the 1820's and 1830's saw that elections could be carried most effectively by careful organization, and so a group of them created the Democratic party between 1828 and 1836. They were clever and did their work so well that, barring accidents, they seemed destined to control permanently; they actually did rule this country, with the exception of two brief intervals, from 1829 to 1861—thirty-two years.

This Democratic party, and the various less successful organizations which attempted to oppose it, were in reality not national parties, as we understand such a term; in fact even our Republican and Democratic groups of today are not as national and centralized as people commonly assume. They are really federations of state machines, and these machines are generally very independent and often hard to handle, as any national chairman can testify. In the period just before the Civil War there was hardly any central organization at all, but some sixty-eight state parties acting with great individual independence.

III

Those chosen by the voters, in such a haphazard series of elections operated by parties so disorganized, must then direct the federal system and must do so ostensibly as representatives of the states. As such they must apportion patronage and appropriations as well as answer legislative demands as federal legislators and officials. They constantly employed diplomatic negotiating and bargaining. Legislation was more like treaty making than statute writing, and it often was done in an atmosphere of bad temper and antagonism, especially as the capital city, Washington, was so badly equipped and so unhealthful.

Their task was the more difficult because federal relations among the states were so difficult. Few of the states were coherent or integrated units of opinion and a large proportion of them were confused by various and conflicting internal interests and views. Such differences often crossed state lines. Even today, understanding of the true nature of the federal system is hampered by the earlier emphasis on state rights and by the fact that certain states once seceded and formed a Southern republic. The North and the South, as the antagonists were then labelled, went to war. This eventual narrowing of the interest to two easily defined belligerents also gives a false impression of simplicity which is projected back into the ante-bellum years. The federal system and its relation to the Civil War need a more penetrating analysis than can be had by concentrating on states and their rights and on the growing antagonism between two entities described as North and South.

Those chosen by the people to operate the federal system were not only confused by the factors just mentioned but they were most handicapped because they failed to understand what sort of federalism they were representing. Before the Civil War the political leaders were deceived because they were thinking of federalism not in terms of the basic cultural situation; rather they were absorbed by an accidental political combination, a union of states. In fact the people of the new republic were not so much the citizens of the several states, or dwellers in two distinct sections growing continually more incompatible, as they were people activated by a series of attitudes. They were living within a cultural federalism, in which men and women of different attitudes were pooling their interests in the operation of a political federal system. The basic fact is the cultural federation of attitudes rather than the political federation of states.

The men and women exhibiting these different attitudes were not isolated and separated by boundaries, they dwelt side by side and on occasion the same person might be moved by more than one attitude, or by different ones at different times. The emotional complex which was created by the variety of these attitudes and the tension which their antagonisms bred added such confusion to that already provided by the chaotic electoral customs and poorly organized parties, that the total precipitated a resort to arms. The baffling problem was not how to maintain a balance among states but how to preserve a balance among a number of emotional units or attitudes. It was this that proved beyond the political capacity of the time.

Of the multitude of attitudes within this cultural federalism discernible during the ante-bellum days, there were five which were particularly

dangerous in their conflict-breeding potentialities. Most prominent among them was a state of mind and emotion best called Southernism, which dominated not only many within the South but numerous migrants from that region as well as sympathizers with its situation who dwelt in the North. Its chief characteristic was its increasing defensiveness, its praise of slavery, its fear that Southern culture was in danger of destruction or degradation. A second divisive attitude was that dominating those eager to see the nation wax in wealth and power, who were anxious to exploit national resources, develop industry, provide transportation, and promote commerce and banking. These interests of the metropolis make it appropriate to speak of this attitude as Metropolitanism. It was characteristic of the era and was found everywhere, but it was less common in the South where the fear grew that such swift development might come at the South's expense. A third attitude, for convenience called Territorialism, was characterized by an intense interest in frontier development, in the organization of territories and the admission of new states. Here fortunes, financial and political, could be made and interest was feverish. The urge for political growth vitally affected state and national politics during the antebellum years between 1815 and 1860, as sixteen new states were created. Most of them emerged from territorial status through political turbulence, in which men from various regions had fought furiously to control the pattern of development in the new communities.

The confusion was worse confounded by two other attitudes which injected a combination of hatred and moral indignation into the turmoil, by Anti-Slaveryism and New Englandism. The existence of slavery in the Southern states troubled many people, as both anachronistic and sinful. Particularly in the Middle West many hated slavery and were moved by an intense desire to abolish it or at least to prevent its extension. Their hatred of slavery often was combined with antagonisms bred of struggles against persons dominated by Southern ways of thought and behavior, over the political and business problems of their states. Furthermore many people in New England were activated by a variation of Anti-Slaveryism. That region had been losing ground politically and people of ambitions or pride felt thwarted. They found that the dominant Southern politicians stood most in their way and their bitterness at their inferiority easily could be translated into hatred of the sin of slavery and into attacks upon the slave power.

This complex series of divisive attitudes—Southernism, Metropolitanism, Territorialism, Anti-Slaveryism, and New Englandism—was underlined, emphasized, and exaggerated by two prevailing attitudes which had no suspicion of sectional location. They were found everywhere and their nature was such as to intensify the emotional stimulus which the divisive attitudes projected. These attitudes were the prevailing Protestantism and Romanticism so characteristic of the time. The first of these two emphasized morality and duty and caused many consciences to be concerned over sin in the community. Because of it there was in the free labor states therefore much hatred of slavery as a sin and a very active and militant group of abolitionists. Sensitive conscience caused people to fight Southern political power in the name of a crusade against a national shame. In the South, on the other hand, the same Protestant attitude prevailed, but slavery was praised as a blessing because it enabled African heathen to secure Christian salvation. There, attacks upon the institution by abolitionists and opponents of slavery-extension were countered by denunciation of Northern materialism, wage slavery, general servitude to Mammon, and hypocrisy, all sins.

The intensity of these feelings was strengthened by the prevailing Romanticism of the period. A rosy optimism precluded a realistic view of the perplexing problems. Virtues and vices stood unqualified. Few people would admit any dangers and most went on sublimely with the most naive concepts of contemporary trends. This romantic state of mind placed a premium upon exaggeration; ideas and emotions that were attractive were embraced without critical appraisal of their validity. There was therefore a minimum of that commodity labelled "common sense." Too few could be convinced that concerted efforts should be made to encourage cohesive attitudes which would counteract the divisive tendencies.

The few who were endeavoring to encourage such cohesive attitudes sought to stimulate Nationalism. They stressed the increasing strength of the nation, natural pride in the creation and maintenance of free institutions. The growing sense of the success of the United States gave some confidence that Nationalism might counteract the divisive attitudes enough to overcome the disrupting tendencies. Others felt that the saving formula should be an appeal to fair play under the classic theory of Democracy. Government should be by

the rule of the majority. That majority which ruled in town meeting and county council, in state legislature and Congress, should rule everywhere. The people could be trusted; by and large the majority in the greatest number of cases was bound to be right. All vexed questions of dangerous import should be referred to the people and everyone should be bound to submit to the will of the majority. Yet neither Nationalism nor Democracy could satisfy the South. Both attitudes assumed that the Southern people as a minority must be subject to the will of others, an intolerable assumption. Yet, since some reconciling formula was necessary, their political philosophers must suggest an alternative. They began to encourage a concept of Regionalism, an autonomy designed to make the enactment of certain types of legislation dependent upon some form of regional consent.

The strength of those leaders endeavoring to encourage the cohesive attitudes was entirely inadequate for the task and they were further hampered by the general lack of understanding of the cultural federalism which was conditioning their problems. They thought they were dealing with a controversy which was primarily legal involving merely a harmonization of rights, state and federal. They sought—just as if they were settling a case at law—to achieve a legal formula which would reconcile states to federal exercise of power and sovereignty. It was an era that throve on legal and political theory, on countless hours spent in oratory and in the writing and reading of those long, theoretical debates which we now think to have been so unrealistic. Unrecognized behind the oratory were the prevailing attitudes, giving direction to such dynamics as moral indignation (which some present-day blasé historians seem inclined to discount), thwarted ambition, fear of loss of face and power, and the countless confusions of a growing state.

The political leaders failed as they were bound to fail because they oversimplified their problem and tried to stop a flood with a sand pile. And this flood reached its crest because they themselves fed it by the constant agitation which rose out of the chaotic electoral system. Contests were waged not only continually but also on two levels, local and federal. The same party organizations had to maintain themselves in power in the states and in Washington; and it was generally more important to maintain their local controls. They frequently brought national issues into state contests because of the greater potential interest. The people of one locality could easily be whipped into political fury about the sins of omission or commission of others in a distant region, and with little risk to the local agitators. This possibility bred irresponsibility about playing with emotional dynamite. Dangerous divisive attitudes were encouraged for local purposes by agitators of narrow vision, heedless of the consequences.

Thus the prime factor that made conflict irrepressible was political. The divisive and pervasive attitudes provided inexhaustible material for political controversy, and the will and the strength to carry it on vigorously whenever opportunity demanded. These controversies reached the blood-letting pitch because the chaotic election program called for contests somewhere nearly all the time. Issues were never allowed to rest. Political oratory, pamphleteering, inflammatory journalism, and more important, corner store and tavern argument, were going on all the time.

The swift growth of population brought a constant demand for the recognition of new political units to be fitted into the federal government and the federal party organizations. Controversy over these political re-alignments became more intense as the conflicting attitudes became stronger. The control of government was more sought after as the growth of the country made federal functioning more vital particularly through subsidy, "protection," and the opening of new territory. The stakes of power were constantly growing higher, with many more men becoming politically ambitious and seeking office more intensively. So the contests were more vigorously waged. Popular interest in them could generally be captured more effectively by predictions of calamity and danger; so, quite heedlessly, literally hundreds of persons seeking public office stirred up increasing apprehension among the voters.

IV

This rising tide of crisis agitation wracked the political machinery operating the federal system. The Democratic party had been in power almost continuously through three decades. Its strength lay in its appeal as a people's party, in the heroic Jackson legend, in a swash-buckling, expansionist, foreign policy, in its effective political organization, but particularly in its laissez-faire philosophy in domestic affairs. On questions of subsidy the party leaders, sensing some of the variety of interests and attitudes endangering the party's control, had avoided such issues by maintaining the federal government as one of very limited powers. It attempted to encourage Nationalism by its ag-

gressive foreign policy. In domestic policy it was more and more sympathetic to regionalism.

But no party in this country has ever remained in power for much more than the life of a generation. As the 1860's approached the ruling Democratic party was more and more cursed by the resentments of those who had been thwarted by its laissez-faire policy, those disappointed in their ambitions for leadership and office, and of course by the rising generation inevitably at feud with its elders. The stage was set for schism and it came.

A new political group was ready to take advantage of these signs of discontent and rebellion. The old opposition party, the Whigs, had never been very effective, in part because it took little advantage of the controversial issues of conflicting attitudes and merely tried to promote the cohesive idea of Nationalism. It was now pushed aside by a new party, the Republicans, who capitalized division. They saw that the majority of the voters lived in regions where metropolitan, territorial, anti-slavery, and New England attitudes existed in profusion and confusion. Heedless of danger they made a catch-all appeal. Combining moral indignation against slavery with promises to various promotional interests, and stressing the theoretical concept of the right of the majority to rule, they had an appeal strong enough to break the long-continued power of the South and of the Democratic party.

The Democratic leadership saw this opposition swiftly rising but were incapable of coherent action to meet it. They were faced with a dilemma. The free state Democrats saw the need of concessions to save their ranks from the onslaught of the Republicans but their Southern associates refused these concessions for they themselves were in danger. They had as their local opponents the Southern branch of the Whig party, which had lost most of the Northern wing to the Republicans and therefore could go all-out for Southern interests. If the Southern Democrats agreed to concessions in the national platform to placate free state opinion, they would be accused by their local opponents of betraying the South and might well be driven from the state governments. Rather than lose local control the Southern Democratic leaders sacrificed their national power, a phenomenon not unusual in American political history. The result was the split of the Democratic party at the national convention in 1860. The delegations from the Gulf states took a walk probably expecting thereby to force a compromise which would restore unity. But then it appeared that the Northern state machines refused harmony because any concessions would destroy their slim chances of maintaining power. Indeed the intricacies of a local feud in New York may have been the immediate cause of the failure of compromise. The system of federally organized parties had resulted in the exaltation of the local over the national and had so hindered the growth of nationally-minded leaders that there were none powerful enough to meet the crisis.

This schism made the election of 1860 unique in American political history. Hitherto there had never been more than two parties, or at most two major and one minor organization, at any one of the Presidential elections since 1824. Now however there were four substantial parties in contest: the Republicans, the Regular Democrats, the Bolting Democrats (largely though by no means exclusively from the South), and the Whig organization transformed by a new name into the Constitutional Union party. In this four-cornered contest the Republicans won, though garnering only forty per cent of the votes, because their minority of the popular votes was sufficient to gain a majority of the electoral ballots.

Then the constant agitation bore its fruit. There were enough Southerners so angered and fearful, after years of alarmist campaigning in their own and in the free labor communities, that they demanded and secured secession by eleven states in the interest of preserving their freedom. In the free states indignation at this attempt to break up the great democratic experiment led to a resort to arms, to preserve the Union against these secessionists.

Thus war came when the American people for the first time refused to abide by a national election. The parties which had been promoting the cohesive attitudes had broken down and their disorganization had permitted the new Republican organization to win through direct appeal to the divisive attitudes. The constant heat generated in the frequent elections brought an explosion. The social, economic, and cultural differences had been so used by the political operators as to produce secession and civil war.

The war came because no means had been devised to curb the extravagant use of the divisive forces. Statesmanship seemed poverty stricken. The work of the nationalists who sought to find the formula with which to overcome the divisive attitudes was vain. Too few even saw the need for the formula; they ran heedlessly down the path

to disruption. In the last analysis the war was the product of the chaotic lack of system in ascertaining the public will, a chaos exploited by irresponsible and blind operators of local political machinery without adequate central organization.

The Civil War fortunately did not spell destruction to the republic. It left its lessons behind it. Growing social coherence, the nationalism accelerated by the war, at length produced more orderly democratic procedures. Elections are now concentrated in the autumn of the even years; there are long breathing spells between campaigns. Parties were better organized with more centralized management. Isolated, irresponsible action became somewhat less frequent. The two party system was resumed. Although there have been a score of small parties and upon occasion three large enough to become major, the disintegration of 1860 has never been repeated.

It is to be hoped that the architects of world federation study carefully the lessons of American experience. Woeful are the results of irresponsible exploitation of divisive attitudes. Strenuous effort is essential to invent political machinery effective enough to keep cohesive attitudes dominant.

TECHNIQUES OF RACE RELATIONS

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MOST Negro and white Americans who object to the prevailing patterns of race relations express concern about existing and impending evils, but seem only casually interested in the practical details of procedures by which changes might be brought about. It is natural that there should be disagreement about immediate objectives and ultimate goals and that differences of opinion about the comparative merits of the possible strategic approaches to desired changes should persist. On these questions personal judgment will continue to determine individual opinions, for they necessarily depend on what people want and the price they are willing to pay. Granted that unanimity on these questions does not exist, it still seems that individuals of any view would want to know about practical means of influencing racial attitudes and behavior.

The accomplishments of any group desirous of altering interracial behavior will be far below the level of potentiality unless the details of race relations techniques are understood and tactically well used. When a group, perhaps a mayor's committee on race relations, a labor union, a race improvement association or a government agency concerned with the Negro, has decided on its goal and appropriate strategy, the effectiveness of its program is still dependent on materials, tools, and craftsmanship. Assuming, for example, that the officials of a labor union want to reduce Negro-white hostility within their local, what should they do? How much can they rely on particular kinds of argument, union regulation, cooperative measures by the management, experimental demonstration, interracial education, and various possible penalties and rewards? What measures have been tried elsewhere and with what success? If one puts oneself in the place of an official charged with planning and operating a program for a definite interracial purpose, the specificity of the problems and the need for technical knowledge and skill become evident. Thousands of public and private officials today have just such responsibility, and they are operating mainly by hunch and homemade rule of thumb with only random, unorganized information about the experiences of others in similar situations.

Dependence on untested preconceptions of the ways in which attitudes and behavior may be changed and failure to check on the effectiveness of their operations are characteristic of those who are working to reduce interracial hostility and conflict. Because the trend of Negro-white relations in the United States consistently has been toward improvement of the Negro's status, it has been possible to claim uncritically that this improvement is evidence of the efficiency of any and all pertinent programs. The reduction in the number of Negro deaths by lynching is probably only slightly related to purposeful activities by racial reformers, and certainly it is impossible to measure the influence of any one reform organization on the number of lynchings, yet its reduction has been cited as evidence of the effectiveness of interracial work. Similarly, wider employment opportunities for Negroes offer convenient if specious reassurance that the time and money spent to remove racial barriers in industry have not been poorly used. These two illustrations should not convey the impression that organizations for the improvement of race relations have been ineffectual, for their accomplishments more than justify their existence. Because they have been moving with the social current, however, it is difficult to tell what parts of their programs have really aided the progress made. Some parts may even have been retarding in their influence. But so long as progress towards their goals has continued, no one has been much bothered about the efficiency of the machinery.

The practitioners' dependence on their own preconceptions is partly the fault of the social scientists. It is logically their function to find out why people behave as they do in specific racial situations, to formulate principles underlying such behavior so that they may be applied in developing means for its control, and to measure the effectiveness of the procedures used in attempts to modify

interracial behavior patterns. This, however, is not what most social scientists interested in race relations have been doing; for the most part they have been busy describing racial situations, generalizing broadly on occasion, nearly always deploring inequities and commonly identifying themselves with reformatory programs to which their scholarly work usually has contributed little more than raw data illustrative of intergroup injustice. The standard studies of lynching, for example, suggest greater concern with the moral issue involved than with scientific understanding of this form of coercive mob behavior. But criticism of social scientists for not being scientific in this area should recognize that all the fields of knowledge which are now at a more advanced level have developed from somewhat similar but now outmoded beginnings. The early humanitarian emphasis on the insane and feebleminded in the study of mental qualities is comparable. Research in any area of human behavior seems necessarily to receive its impetus from a pressing concern with a social problem which leads first to broad studies of its extent and general nature and thence to objective testing of specific hypotheses as details are clarified and methods improved.[1]

The field of race relations is now well enough defined and research techniques well enough developed to permit analyses which will produce results useful in social engineering. This means that the day of the general student of race relations is about over. The field is too extensive to be encompassed by any one scholar short of a genius. Of course some individuals must always attend to synthesizing the results of research by specialists, but advances will depend on detailed investigations by men who concentrate on particular aspects of race relations rather than on the general subject. After all, the problems of race relations are never just problems of race, but also of school curricula, school administration, adult education, industrial relations, agriculture, public administration, politics, law enforcement, recreation, and every other aspect of community life. Group discrimination and conflict always occur at some point of contact, as at work, in a store, in school, in the military services, on a city street, or on a bus. Yet the men who have expert knowledge of the various areas of human interaction rarely have paid more than superficial attention to the circumstance that their problems are complicated by the color of some of the individuals involved. On the other hand, students of race relations who have become really expert in any one area of interracial contact are also rare.

What the social engineers need from research in addition to data about the nature and causes of Negro-white discrimination is information about the conditions of cooperation and the relative merits of techniques by which group hostilities may be reduced. So far most research has been on problems of racial maladjustment. It is much more exiciting to study riots than it is to try to find out why no outbreaks have occurred in a community where they might reasonably be anticipated. It is also more interesting and easier to write about barriers to Negro progress than it is to study conditions which have facilitated it. From the engineering point of view, this is analogous to learning all about defective timbers and flawed girders while ignoring the qualities of sound materials. Of course maladjustments must be studied, and much more effectively than they have been, but just as much and possibly more can be learned from the more common and less dramatic examples of interracial accommodation.

Literally millions of dollars have been spent since World War I for the direct purpose of reducing interracial tensions; and no student of race relations nor anyone else has demonstrated the value of one type of activity compared with another. The War Department produced a motion picture, *The Negro Soldier,* in 1944 with the dual purpose of improving Negro morale and reducing white prejudice in the interest of military efficiency. Yet there was no way of knowing whether this film was effective. Nor was there any conclusive investigation of the influence of other films used by the Army or distributed through the Office of War Information for similar purposes. Over two million copies of a pamphlet designed to facilitate Negro participation in the war, *Negroes and the War,* were printed by OWI without pretesting or adequate subsequent checking of the efficiency of the publication in terms of its avowed purpose. Dozens of programs are in operation today under government and private auspices with the hope of furthering interracial cooperation; and most of these programs are planned merely in accordance with someone's hunch as to what may be effective. It is difficult to imagine any device which might conceivably influence group behavior

[1] The interests and approaches of social scientists and other writers on race relations in recent years may be judged by consideration of the titles of books and articles listed in the selected bibliography prepared by Julia Waxman, *Race relations* (Chicago, Julius Rosenwald Fund, 1945).

which is not used extensively by racial liberals with the purpose of improving Negro-white relations—and with the opposite purpose by persons less democratically inclined—and nobody knows what return any one device has brought for the money and effort invested.

It is probable, of course, that most interracial techniques employed by individuals and agencies experienced in the field are influential in the direction intended. The question, however, is not whether something is being accomplished but whether maximum results are being obtained. The specialists disagree too violently about both strategy and tactics to inspire confidence that they are sure of the efficacy of their proposals. From the quarrel among the experts over the OWI pamphlet just mentioned, the public could only be convinced that no one of them could prove his position correct; and there was in fact no conclusive evidence that the material in the pamphlet was either reasonably well or badly designed for its purpose. Personal judgments based on the experience and prejudices of the individuals in authority decided that the pamphlet would be issued in spite of adverse opinions officially expressed by at least equally experienced and no more prejudiced "experts." And this is the manner in which practically all decisions on procedures in interracial campaigns are reached.

The fault is not alone that of the social scientists who have neglected to analyze techniques in operation; at least an equal share of the blame must be assumed by the active workers in the field. Because of their characteristic resentment of investigation and indifference or hostility to any questioning of their procedures it is an uncomfortable field for research. These workers expect criticism of their goals and dispose of it to their own satisfaction by writing off the critic as an evil person. They have no psychological preparation or operative mechanism for accepting neutral scientific investigation of their techniques and adapting their work to it. In the American tradition every man is his own expert in human relations unless he learns that the scientist can help him if given a chance. Few race relations workers have discovered this, and fewer still are the supporting philanthropists who are willing to spend one dollar for research so that other dollars may be more wisely used. Men who would not think of investing in a business without examining its efficiency contribute freely to racial action programs without asking for evidence that what is promised actually can be accomplished by the methods proposed. Indeed, it is usually considered bad form to ask how one may know that desired results are being obtained.

The absence of concern about interracial techniques is evident in reports of current projects, such as *City Planning in Race Relations,* the official summary of the proceedings of the Chicago Mayor's Conference on Race Relations held in February, 1944, under the auspices of the Mayor's Committee on Race Relations. This report does not include a paragraph of discussion of techniques, nor make any reference to the fact that objectives are useless unless specific means for their accomplishment are provided. Yet the recommendations made by a subcommittee on employment might well have precipitated a discussion of practical procedures had there been a live interest in them, and the participants in the Conference included as fine a selection of outstanding workers in race relations as could be assembled in any metropolitan area. The report indicated reasonable agreement about objectives and the essence of the task ahead was consequently that of finding effective ways of working toward them. But apparently a session on this subject was not thought worth while in a conference on planning for the improvement of a most difficult aspect of human relations, although the Mayor's Committee already had set up an executive office "to work out and put into effect specific programs to bring minority groups into full participation in the life of the City" (p. 4). The assumption must have been that the detailed ways of working were either obvious or unimportant.

San Francisco is another city which has the advantages of the best available interracial advice and a cooperative interagency program for minority integration. A mimeographed report entitled *Formation of the San Francisco Civic Unity Council,* prepared by the Pacific Coast Regional Office of the American Council on Race Relations, reviews the growth of the Negro population in consequence of the war, the increasing concern of the racially liberal citizenry, a study of *The Negro War Worker in San Francisco* published in May, 1944, a conference looking toward a single community-wide citizens' organization to combat racial tensions held in September, 1944, the personnel in attendance, the recommendations of the conference, the formation of the Council for Civic Unity and the appointment of an official mayor's committee to advise on race relations. There is no reference to technical operational problems in this re-

port, no recognition that means to the end of civic unity are either debatable or important.

The affiliations of the San Francisco Council's officers and directors elected at the September, 1944, conference are on the whole typical of community leadership throughout the country and may be taken as indicative of the points of view which dominate movements to better race relations. As listed in the report, the group includes local government officials; educators; officers and members of minority group organizations; Negro ministers and school teachers and prominent members of other minority groups; representatives of religious groups, the YMCA, YWCA, local council of churches, National Conference of Christians and Jews, American Friends Service Committee, etc.; representatives of the Community Chest and other welfare organizations; officers of the local Councils of the AF of L and CIO, members of committees of these organizations and business agents of local unions, Director of the Labor School; officers of parent teachers associations, federations of women's clubs, and other civic organizations; prominent attorneys, usually active in politics, unions, or cases involving minority discriminations; financiers and business men evincing interest in the public welfare; persons active in community projects, social and political organizations, the Junior League; wives of judges and other prominent citizens. With a few additions, such as a specialist in some medium of mass communication or a college professor, the list would represent the forces in interracial leadership anywhere outside the South and would not need much modification to be typical of the liberal interests there.

The outstanding recommendations presented to the San Francisco conference by panels selected from among the three or four hundred participants are similarly typical of those formulated by such groups, and are summarized in the report previously cited, as follows:

RECREATION. 1) That a training course in interracial leadership be sponsored by the Community Chest to help leaders to understand differences; 2) that agencies, as quickly as possible, place on their staffs and volunteer groups members of the minority groups; 3) that the Board of Education be importuned to set in motion a program of interracial education; 4) that the Board of Education be urged to extend further the use of school facilities as community centers; 5) that churches of all denominations extend the use of their facilities for the Community Chest program in which all racial groups might participate.

HOUSING. 1) Through an extensive study in San Francisco, or elsewhere, "Nail the Falsehood" that minority races reduce the value of property; 2) take action to assure that urban redevelopment legislation include safeguards against discrimination and segregation; 3) a legislative campaign in combination with an educational campaign to eliminate the policy of segregation.

COMMUNITY ATTITUDES. 1) Appointments to city governmental boards and commissions be opened to qualified members of all racial groups; 2) appointment by the Mayor of an official government commission on race relations; 3) "truly fair" representation of all groups in all city departments.

EMPLOYMENT. 1) A permanent FEPC be established; 2) a committee be set up to study ways and means of utilizing minority groups in commercial fields of employment; 3) all government benefits should be withheld from any organizations which refuse to abide by any FEPC ruling.

HEALTH AND WELFARE. 1) Study and support plans for adequate medical care for all; 2) study and support an adequate program of health education in cooperation with existing organizations working in this field.

SCHOOLS. 1) Students in teachers' training institutions should be required to take courses in the historical backgrounds of minority groups, in anthropology, and in interracial, intercultural relations; 2) teachers now in service should be required to take similar in-service courses and be furnished with the necessary materials for instructing their classes in these subjects; 3) PTA groups should make their chief aim the eradication of prejudices among parents and others through courses similar to those recommended for teachers; 4) fair representation of minority groups in the teaching body of San Francisco; 5) abolition from high school life of fraternities and sororities.

These recommendations are not quoted either as the best ever produced or for the purpose of criticism, but because they so clearly and concretely represent the current stage of thinking of those who control action programs. Since these programs constitute the only planned efforts to meet both the daily problems of interracial adjustment and any impending crises of conflict, the recommendations are discouraging in their reiteration of democratic racial orthodoxy without evidence of progress in practical implementation. There would be less cause for discouragement if they were the quick product of lay discussion, but in this instance there actually was a reasonable period of preparation with expert advice and aid.

The proposals vaguely imply full minority integration as the objective although they skirt the issue and give the impression that piecemeal mi-

nority advances are about all that is anticipated. The old standbys, legislation and education, are blithely expected to get the desired results. Minority representation in government and private agencies is demanded. The problems in each of the six areas covered are unrealistically simplified so that, for example, community attitudes become a matter of minority representation in government and the appointment of a city commission on race relations; and discrimination in employment is to be attacked by legislation and a committee for further study. If the shortcomings of programs of this kind are not evident to the reader, comparison with a standard public health program for a community or with the work of a city planning commission will reveal marked contrasts both in clarity of purpose and in specificity of operational techniques.

This discussion of San Francisco's mobilization to meet problems of race relations carries absolutely no implication that the city would be about as well off if no such effort had been made. On the contrary, the cooperative organization of the citizens and agencies with racially liberal purposes in San Francisco and in many other cities throughout the country already has borne fruit in serving notice that the forces of race prejudice will meet more solid opposition than ever before and in ameliorating an appreciable number of tension-breeding situations. Such community efforts are an important resource for averting anticipated post-war conflicts. Criticism of the ideas which are their current tools of operation is for the sole purpose of calling attention to general deficiencies in race relations techniques in the hope that their recognition may speed their remedy.

During the war there was a heartening if quantitatively slight increase in the production of technical guides for executives, administrators, teachers, and others faced with problems of race. One of the first and best was a pamphlet prepared by an economist, John A. Davis, to explain to employers specific procedures for introducing minority workers into new jobs.[2] An anthropologist and a specialist in police administration collaborated in the preparation of a manual on police techniques for preventing riots and improving relations between different racial, religious, and nationality groups.[3] The War Department prepared a manual on leadership of Negro soldiers designed to give officers the best available information on practical procedures. Sociologists, psychologists, anthropologists and others experienced in race relations as well as professional military men contributed to this publication.[4] The Navy Department also issued a technical guide on Negro-white relations for the use of all Naval officers.[5] The Bureau for Intercultural Education has sponsored a number of publications giving detailed advice on ways of reducing interracial intolerance; included in an extensive series of teachers' aids are a volume on the educational development of cultural democracy,[6] and one on the controlling factors in race prejudice.[7] A yearbook published by the Department of Supervisors and Directors of Instruction of the National Education Association contains an excellent chapter of specific suggestions for the implementation of programs in intercultural education.[8] Labor groups are showing increasing awareness of the need for practical guides for the use of their members in programs for intergroup cooperation.[9] Other guides are addressed to community leaders and members of local organizations. The American Council on Race Relations has issued a booklet[10] designed to help communities examine and solve their own intergroup problems. In the belief that scattered individual efforts could be made more effective by technical assistance, the Writers' War Board early in 1945 distributed a kit containing five speeches, a quiz, a parody, and a pamphlet for use in promoting racial and religious tolerance through meetings, articles, radio speeches, or even letters to local newspapers. The campaign against anti-Semitism has been responsible for much of the rising interest in techniques of racial adjustment, and reference should be made to a resulting publi-

[2] John A. Davis, *How management can integrate Negroes in war industries*, New York State War Council, Committee on Discrimination in Employment, 1942. A well selected, brief bibliography is included.

[3] J. E. Weckler and Theo E. Hall, *The police and minority groups*, Chicago, The International City Managers' Association, 1944.

[4] *Leadership and the Negro soldier*, Army Service Forces Manual M5, 1944.

[5] *Guide to command of Negro Naval personnel*, Navy Department, Bureau of Naval Personnel, 1944.

[6] William E. Vickery and Stewart G. Cole, *Intercultural education in American schools*, New York, Harper & Brothers, 1943.

[7] Hortense Powdermaker, *Probing our prejudices*, New York, Harper & Brothers, 1944.

[8] Marion Edman, The role of the instructional leader, Chapter XXIV in *Americans all: Studies in intercultural education*, 301–306, Washington, 1942.

[9] For example, see Theresa Wolfson et al., *Overcoming prejudice*, New York, American Labor Education Service, 1946.

[10] Robert C. Weaver, *Community relations manual*, Chicago, American Council on Race Relations, Community Services Division, 1945.

cation which explains the principles of "racial scapegoating" and suggests ways for counteracting it.[11] There are numerous other publications emphasizing definite things to do to prevent interracial conflict and to minimize its consequences when it does break out, but enough have been cited to exemplify a new and hopeful trend toward practicality in thinking on race relations.

One book which makes only passing reference to the Negro should be read by all concerned with Negro-white relations even though they deny the slightest interest in the minority on which it is based, American residents of Japanese origin. In *The Governing of Men,* Dr. Alexander H. Leighton, psychiatrist and anthropologist, tells the story of the relocation center at Poston, Arizona, and draws from his intensive study of this community principles of behavior and administrative recommendations which deserve the most thoughtful consideration by every person with any responsibility in Negro-white relations.[12] The results of the Poston study may not be wholly transferable to any other minority situation; in all likelihood they are not perfect even for Poston. The ultimate is hardly to be achieved in a path-breaking study. The point is that a painstaking attempt was made to find out what was going on in a minority community under great stress, what principles of human behavior were involved, and how desired objectives could best be achieved. The emphasis on techniques for the accomplishment of definite objectives is without parallel among the countless studies of the Negro in the United States.

It would be premature in our present state of knowledge to attempt a positive and inclusive statement of principles and methods for the guidance of workers in Negro-white relations. However, decisions on tactical details are having to be made daily not only by professional workers but also by public spirited citizens who feel obligated to make whatever contribution they may to national unity and by individuals in government and private business who realize that their normal activities involve interracial responsibilities. The laymen among them, at least, may be aided by an exposition of the most common sources of operative confusion.

One weakness of many interracial activities is failure to accept the principle that problems of race relations are essentially the same as any other problems of group relations. In spite of differences in detail, the principles and procedures which tend to reduce group hostilities and increase cooperation in the area of race are essentially the same as those which work in any other area of group conflict. Of course, the background and present status of the Negro American are in many respects unique, but the same is true of any other distinctive group in the population, such as the white sharecropper, the Mexican of the southwest, or the distressed coal miner of southern Illinois. The assumption that problems of Negro-white adjustment are somehow generically unique is practically certain to be fatal to cooperation since it implies belief in some kind of racial dogma which sets Negro and white apart from each other. National unity can hardly be achieved on such a premise.

Race improvement programs already recognized as outmoded illustrate the difficulties created by falling into the error of assuming that work with Negroes requires tactics of a special order. Until recently, it was almost universally believed that Negro health programs must take into account inborn susceptibilities of the Negro to a number of diseases, especially tuberculosis. It is now recognized that certain diseases are relatively prevalent among Negroes because of the way they live and that these diseases yield to the same health measures that are effective among the white population, with only such changes as are necessary to adapt them to any particular socio-economic group. Similarly, not so many years ago leading educators were convinced that Negro education either because of differential mental qualities or environmental limitations had to be of a special character, mainly that typified by the original Hampton-Tuskegee vocational idea; now it is accepted as a matter of course that Negro schooling should follow the general educational pattern, varying with the ability and opportunity of the individual, not his race. A third historical example is the attitude of resignation toward Negro morality and crime which was once so completely dominant that even many of the most kindly disposed white people assumed that little could be done beyond protective and paternalistic control of the most shocking derelictions. It is only relatively recently that we have discovered that the conditions which produce disease, illiteracy, and crime fundamentally are the same for Negroes as for others.

Among racial democrats any belief that inborn

[11] *A B C's of scapegoating,* with a foreword by Gordon W. Allport, Chicago, Central YMCA College [n.d.; 1943 or 1944].

[12] Alexander H. Leighton, *The governing of men,* Princeton Univ. Press, 1945.

racial differences in mental ability and temperament have been demonstrated has been dissipated, but in its place there is an uneasy suspicion that Negroes as a race may have minor and practically undiscernible qualities which cannot be entirely ignored although they must never be mentioned in public. More open is the conviction that Negro behavior differs so much in degree from that of the assumed typical American that it might as well be considered a difference in kind. As many Negroes suspect, this may be partly an unconscious rationalization of suppressed belief in unproven biological differences, and partly a manifestation of guilt for the discriminations which have actually produced such differences as do exist. Whatever the origin, it shows up in a tendency to be apologetic for the Negro, defensive of his inadequacies and protective as of a child. For example, programs designed to enhance white appreciation of him most frequently emphasize not the accomplishments of a man earning his own way but racial specialties like the spirituals or ordinary achievements in the arts, sciences, and working world which would be worthy of exceptional mention only if the product of precocity.

No matter how well intended, such evidences of lack of confidence that Negro-white relations can follow ordinary human patterns are ruinous to any program for national unity. If cooperative interracial adjustment is the purpose of a radio script, an interracial meeting, an employment policy, a welfare program, or any other plan, it should be scrutinized microscopically to make certain that it takes Negroes for granted as normal human beings differing only in physical appearance and in some aspects of their cultural conditioning.

Acceptance of the concept of the unity of mankind has a corollary which seems equally obvious as a tactical principle but it is more often disregarded than heeded: Emphasis in education or in any kind of informative propaganda on Negro accomplishments popularly regarded as racially characteristic is an influence in the direction of differentiation and retards the process of integration. Such emphasis in its effect on popular attitudes if not in its logic contradicts the idea of unity and reinforces stereotypes which give support to doctrines of racism. No one doubts that the usual derogatory stereotypes of the Negro are a barrier to the improvement of his status. It is much less easy to understand that favorable stereotypes of the Negro as a born singer of spirituals and work songs, a natural creator of hot jazz and blues, a dancer endowed with a superior sense of rhythm or a superb athlete by racial inheritance also mark him as unique and help to maintain the cleavage between black and white. Such credits imply a biological theory of race differences just as surely as do unfavorable stereotypes, but this implication is too often overlooked. The cosmopolitan sophisticate can appreciate the folk contributions of Negroes, which are so constantly presented to the public to win friends and influence opinion, without drawing divisive inferences; but most white Americans accept such arts as gifts of a more primitive race and not as products of civilization. Many Negroes sense this differentiating inference and are disturbed by being put on display with their specialties. When the Negro has become secure in a better status his special cultural gifts to American life will no longer be a danger to him, but meanwhile they should be handled with care. There need not be complete avoidance of accomplishments characterized as Negro, but the current emphasis on them should be reduced and supplemented by greater stress on achievements of individual Negroes to which no racial tag can be attached.

Interracial tactics should be designed so that white people and Negroes may become increasingly used to each other under the normal circumstances of community life to the end that an individual's race will not be the focus of attention in any contact. Emphasis on the Negro as a Negro or on white people as white people works against this purpose. Notice of a Negro waiter, janitor, gardener, or other traditional service employee is only secondarily attracted to race, and so it should be with Negro stenographers, clerks, lawyers, businessmen, or public officials. Race relations can be eased as people get used to seeing Negroes in these capacities and in stores, hotels, parks, trains, and other public places, provided of course that the numbers are not overwhelming and that individuals conform to the customs of the locality in appearance and behavior.

It is possible and frequently relatively easy to introduce Negroes into new places and roles in such a way that the public will become accustomed to the change without serious incident. Negroes are widely employed in the postal service without public notice. Negro policemen and firemen are becoming increasingly common although it is not so long since such employment was generally thought daring. At the beginning of the war Negro Army officers attracted curious and uneasy stares on the street; a Texas enlisted man is said to have been court-martialed for trying to take the uniform off

the first Negro officer he saw because he did not know that Negroes could be commissioned. There are sufficient numbers of schools in which Negroes instruct white pupils, hotels and restaurants which serve both Negroes and whites, businesses in which Negroes work with white fellow employees, stores which are patronized by members of both races, and so on, to demonstrate the practicality of increasing the areas of accustomed contacts. Both skill and luck, however, usually are needed in the introductory stage.

The Negroes who break the ice should be similar in personal traits and qualities to their new white associates, that is, they should be distinguishable only by color. The entry should be matter-of-fact without fanfare or apology. Preparatory announcement, debate, and stage setting should be kept at the minimum justified by advance estimates of possible difficulty. Once the first step has been taken, those in authority should be watchful for incidents which might grow in importance and respectfully firm with potential trouble makers. And the proportionate numbers of the minority can be a crucial factor. Of course, interracial situations have adjusted themselves smoothly when none of these precautions were observed, and trouble has arisen in spite of careful planning. The odds, however, are made more favorable by conscious effort to ease new interracial contacts until they become routine, always remembering that every situation has its own peculiarities and that one sure way of blocking Negro advance is to make it a crucial issue in the minds of the controlling white community.

Harping on conflict and mistreatment is another way of emphasizing racial cleavages. The right of Negroes to protest discrimination and the obligation of responsible citizens to fight injustice must be maintained, but fine judgment in tactics is required when defense measures threaten to cost more than they gain.[13] The constant publicizing of general evidences of prejudice and of specific instances of racial inhumanity stimulates corrective action by some individuals but it also unconsciously reinforces the feeling in others that Negroes and whites are inevitably in separate camps.

Negro leaders might well give thought to the prevailing tactics in the battle against anti-Semitism which avoid newspaper trials in even flagrant cases of discrimination in favor of direct off the record protest to persons in a position to do something about it. Some of the so-called tolerance organizations with Jewish support have a tendency to fight more loudly against discriminatory treatment of non-Jewish minorities than of Jews. The argument that it is not entirely to the Negro's advantage to have a disproportionate share of the struggle against racial bigotry waged over his shoulder may not be without merit.

Protests must be made; the public cannot be encouraged to feel that all is sweetness and light on the Negro-white front; and it is to the advantage of those who are negotiating for racial advances to have a softening-up barrage of protests and threats fired ahead of them. Furthermore, the Negro does not yet have the financial and other resources necessary for a campaign similar to that against anti-Semitism. Pounding away with protests is the least expensive method of fighting at his command. The problem is one of fixing the point of diminishing returns—of determining the circumstances under which protests raise barriers between the races, increase the spirit of hostility in both groups or lose force through becoming too commonplace to be emotionally effective.

It is good technique to keep members of both races accurately informed about interracial questions. There is no better way to answer false assertions, kill tension-breeding rumors, and build a solid foundation for democratic action. This principle is generally accepted, but it is commonly misused because of fear that if the truth is not entirely laudatory of the Negro it may lead to greater prejudice. Also, because Negroes are sensitive and quick to infer insults from even the most objective statements at variance with their customary propaganda, racial liberals are reluctant to risk giving offense. The twisting or omitting of facts, exaggeration and plain prevarication in defensive arguments about race and crime, industrial skill, educational and scientific achievement, military accomplishment, literary and artistic products, etc. are commonplace. But the unvarnished truth alone contradicts racial dogma, checks rumors, and in precluding specious rebuttal is more effective than the most kindly white lie. Unless the established facts are adhered to rigidly, and both weaknesses and strengths honestly included in interracial edu-

[13] In the early years of the war the constant one-sided criticism of the War Department by the Negro press reinforced the conviction that stringent racial separation among troops was essential. Racial issues were made extra difficult to resolve by this punishment of officials. Later when the Negro press increased its rewards of praise for specific racial improvements the response in better relations and positive actions was promptly noticeable, even though criticisms continued to be freely printed when the editors thought they were deserved.

cational campaigns, the main results are likely to be a lack of public confidence and a weak foundation for action programs.

A second reason for the misuse of informational techniques in interracial activities is the aforementioned American faith that facts alone must modify attitudes in a uniform, predictable direction. This faith has made too many practitioners forget that varying and even opposite conclusions can be drawn from any set of data; for example, evidence of the Negro's industrial capacity may lead to the conclusion that he should be industrially integrated or that barriers should be erected to protect white men in their jobs, depending on the background, prejudices and personal motivations of the analyst.

Probably it has been necessary to reply at length and in detail to the racial nonsense of the pseudo-scientists who did Hitler's work, but there is no justification for the complacency with which the public has been deluged with the negative evidence of research on race differences in ability, as a cure for the diseases of race prejudice. Just as men have long been able to compromise creed and practice, they are finding it possible to compromise conflicts between the facts of science and their personal preferences. Oral or written demonstrations of the lack of any known biological foundation for racist theories have their utility in counteracting false popular notions, but are not decisive in racial attitudes and practices.[14] Instruction in the psychological and social facts of everyday interracial behavior is much more practical.

It is always good tactics for members of both races to work in association on interracial questions. Any minority not crushed in spirit resents outside domination even for the best of purposes; and fewer mistakes will be made if there is free consultation and cooperation between the races in any project of mutual concern. Neither group admits any particular objection to this practice, but inter-group participation frequently appears grudging and superficial, as if it were more a gesture than a sincere effort made with confidence that good would come of it. Probably the main reason there is not more and better cooperation is that it is so hard to find the right people of whom to ask assistance and advice.

White interracial workers have a spotty record in their choice of Negro consultants and associates. In the first place, there are as few Negroes as whites with recognized wisdom and skill in race relations who do not have personal axes to grind. Second, those Negroes who make a profession or a hobby out of guiding white men's interracial thoughts and dollars are well known, ever-present, and not easily avoided. Although their customarily cautious advice is usually safe, it is also genarily orthodox to the point of stagnation. A third difficulty is that Negro aid which will not be troublesome is often what is wanted. Above all, white people probably make their greatest mistakes in choosing Negro associates because of a naive faith that all Negroes are expert in matters of race. The simple rule that works best when seeking aid in an unfamiliar group is to think through the qualities and skills needed and then search for the person who meets the requirements, just as one would in filling a vacancy in any business. Both white and colored individuals with something to contribute to any venture can always be found if they are honestly sought.

Negroes seem more sophisticated in their selection of white associates. They know what they want from the white man, and it is usually not advice or interracial skill but the advantages afforded by money, prestige, and power. These are rare commodities among Negroes and largely have to be imported from across the racial line. While Negroes on the whole are not unwilling to accept white cooperation in efforts to improve their status, they are doubtful about the possibility of getting much help and seem to prefer to carry on alone. White staff members are not wanted in Negro improvement organizations although boards of directors may be racially mixed and funds secured mainly from white sources.[15] This tendency reflects many things: a natural clannishness, suspicion of white sincerity, desire to avoid embarrassing situations, an understandable attempt to protect the professional jobs which are open to Negroes, and an urge on the part of Negroes to control as much of their own destiny as possible. It would seem tactically wiser to encourage the identification of white liberals with all movements

[14] For example, it is commonplace knowledge even among racists that no unmixed *race* of humans now exists in the biological meaning of the word, i.e., a group of people with common physical characteristics because of common ancestry. Yet they continue to be racists because no matter what biological nonsense they prate, they are really concerned with groups which have socio-psychological if not ancestral reality. Science can destroy racist theories with ease, but racism persists because it neither originated from nor ever has been dependent upon the results of scientific study.

[15] The March on Washington movement advertised that contributions from white people would not be accepted.

for the improvement of Negro-white relations, strictly on the basis of individual qualifications.

The white tendency to regard all Negroes as expert in race relations and as morally obligated to exhibit racial altruism is productive of indignation and discouraging disillusionment when contrary behavior is observed. In Negro-white cooperation for a common democratic purpose, disillusionment can be avoided only if members of both races assume that their fellows of another color are only human. There is no more reason to expect Negroes to be omniscient and socially minded than to condemn white individuals unheard as ignorant bigots. Similarly, there is no more justification for uncritical acceptance of advice on interracial tactics from a Negro source than there is for rejecting suggestions of white origin. Interracial discussions, however, are now dominated by a tacit rule that Negroes know best how to meet the difficulties against which they protest and may not be openly disputed by a white man without raising suspicion of reactionism—a rule reminiscent of the white southerner's claim that he alone knows how to handle the Negro. Interracial cooperation in the improvement of race relations will continue at a low level of efficiency until the participants come much closer to accepting each other on the basis of individual knowledge and experience.

Finally, the most elementary tactical principle of all is that organized, coordinated action is the most effective form of operation. The more agencies there are working for the adjustment of race relations the better the chance of success for all, provided that they know about each other's activities and cooperate in their common purposes. It is not necessary and probably not desirable that all similar agencies, such as those working through the schools or those fighting for civil rights, be welded into one national body. Constant clearing of information, consideration of the possibilities of mutual supplementation and support, and strict avoidance of interagency sniping constitute about all the coordination that is essential. In the educational field, for example, it is all to the good that three national agencies—the American Council on Education, the National Education Association, and the Bureau for Intercultural Education—all work in the interracial field, so long as they remain alert to the dangers of competition and take advantage of opportunities for cooperation as they arise. And these three agencies at the national level each have been able to work with innumerable less extensive agencies where good will prevailed, without any compulsive element in the relationship. The American preference for voluntary, loose association of agencies engaged in a common cause holds in race relations, as elsewhere, and is no handicap to coordination of programs if professional jealousies can be subordinated.

The need for interagency coordination cannot be fulfilled without business-like intra-agency organization. Every activity should be carefully examined periodically to see that the results are satisfactory and in proportion to the cost. It should not be assumed that any well intentioned plan is working as hoped. In any proposed undertaking the first question should always be whether similar work has been done previously and if so, with what techniques and what results. Usually all that can be determined is that scattered precedents exist and that there are many practically unsupported testimonials and some criticisms regarding each. Because of the uncertainty about the effectiveness of interracial techniques, discussed in the first part of this paper, there is exceptional need for controlled experimentation before embarking on full-scale operations and for definite provisions for gauging the results of all projects.

Racial democrats cannot afford to trust to good hearts and good luck. Their opponents, the nativists and racialists, know what they want and they know the strategies and tactics most useful in accomplishing their purposes. They know the value of organization and the futility of wasting time in criticism of others who are on their side even though they may be ultimate competitors for the spoils. Severe national crises in the United States always have been followed by a surge of racialism whose advocates had the advantage of relatively unorganized opposition. It is true that such groups ultimately lost their influence, as in the cases of the Know-Nothing Party of the 1850's, the American Protective Association of the last part of the nineteenth century, and the modern Ku Klux Klan; but credit for their belated defeat is to be ascribed to the general social trend rather than to any purposeful attack by liberal elements. For the first time in American history there is now a chance that following a national crisis the forces of racial liberalism will be reasonably well organized in support of a composite program under which a multitude of private and governmental agencies will be working by varied approaches and techniques for essentially identical purposes.

This favorable position of the liberals is attributable largely to the great role of conflicting racial ideologies in World War II, and to the fact that

the dangers of rising anti-Semitism spurred the most sophisticated and advantageously situated minority in this country into the best financed and best organized campaign for minority civil rights the nation ever has known. General recognition by minority leaders in recent years that from a purely selfish point of view no one minority can afford to be unmindful of the rights of any other has also advanced the Negro cause. But Negroes themselves and their co-workers for the improvement of Negro status are giving evidence of an increasingly practical and cooperative spirit.

During World War II two conferences were held in the South which were indicative of a trend toward a rational united front among racial liberals which has significant potentialities. A group of southern Negro leaders met in Durham, North Carolina, in October, 1942, to prepare a statement which could serve as "a basis for interracial cooperation and development in the South." The conferees were from varied ideological camps, yet they reached agreement on a clear statement of the racial issues in the war, in political and civil rights, industry and labor, agriculture, education, military service, and social welfare and health. There was a minimum of emphasis on emotionalized shibboleths and a maximum of attention to specific goals. At the very least, a basis for practical negotiation and action was laid.

In April of the following year a group of southern white liberal leaders met in Atlanta, Georgia, to consider the Durham statement, which they found "so frank and courageous, so free from any suggestion of threat and ultimatum" and so indicative of good will that cooperation was gladly offered. The statement resulting from the Atlanta conference did not attempt to parallel the Durham statement but suggested that there were some differences of opinion, expressed agreement on certain issues and reached this conclusion: "It is futile to imagine or to assert that the problem will solve itself. The need is for a positive program arrived at in an atmosphere of understanding, cooperation, and a mutual respect." [16] The Southern Regional Council with headquarters in Atlanta is a war-born agency which functions in accordance with the philosophy of the Durham and Atlanta statements.

The American Council on Race Relations, organized in 1944 with its main office in Chicago, "aims at the progressive elimination of discriminatory practices which breed racial tension" by helping local communities in their own efforts to solve interracial problems in cooperation with existing local and national agencies. While this organization is primarily concerned with Negro-white relations, it recognizes the common elements in discrimination against all minorities and in spite of limited facilites already has been active in situations involving groups of Japanese and of Mexican origin. It assumes that Negro-white relations are not independent of a community's other racial attitudes and behavior, and that all interracial agencies have basically similar objectives and can profit by a maximum of cooperation. It is the first national agency created to serve as a clearing house for interracial experience and technical knowledge, supplying materials and skilled workers on request insofar as its facilities permit, and assisting other agencies to coordinate their work with a minimum of duplication or conflict.

The Southern Regional Council and the American Council on Race Relations are not nearly adequate for the tasks which face them, even in conjunction with the many agencies with more restricted programs whose work they supplement. These Councils are woefully short of money, personnel, and materials; their policies and techniques are far from perfect; and they have yet to receive a full measure of cooperation from the organizations and individuals who are seeking the same ends by different paths. With all their limitations, however, these two agencies are performing functions previously allowed to go by default and they indicate that racial liberals are beginning to want to be as well organized and as practical in their work as the situation demands. What will happen after the war depends to no small degree on the development and support of these two Councils.

Unfortunately there are signs which suggest that the rational, organized approach to race relations may be overwhelmed by disagreements, suspicions, prejudice, and conflicts among those who are alike in wanting progress toward racial democracy. Perhaps the most portentous of these signs is the evidence that many professional liberals are intolerant of all who do not see eye to eye with them. Never before has it been possible for Negro Americans and those concerned with their welfare to speak so frankly and protest discriminations so violently, with so little fear of public disapproval and so much psychological reward as has been the case in the past few years. In the exer-

[16] For the full text of the Atlanta and Durham statements, see C. S. Johnson and Associates, *To stem this tide*, Appendices I and II, Boston and Chicago, The Pilgrim Press, 1942.

cise of this new-found freedom there is a carelessness of the freedom of others.

Respect for the integrity of others is the obligation of those who demand full status for themselves. It is dangerous enough to democracy to demand, as so many advocates of individual freedom now do, that advocates of racist dogma should be hunted down and prevented by force from presenting their views. To refuse to give full freedom and respect to fellow liberals who differ in their concept of liberalism is fatal to the common cause both because it sanctions a pattern of repression and because it divides natural allies who need each other's support. It is to be devoutly hoped that those who fight intolerance will themselves have tolerance enough to work together.

INDIA'S PAKISTAN ISSUE

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(*Read October 19, 1946*)

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1. URGENCY OF THE ISSUE

THE most critical issue of politics in India today is that of Pakistan. This is an issue of internal affairs, growing out of the rivalry between India's Muslims, the country's largest minority, and the Hindu majority, which outnumbers it by about eight to three. The rivalry between these two communities is called "communalism" in India, and Pakistan is the issue on which communalism is focussed at present. It is the prime, almost sole, aim of the All-India Muslim League, which is the country's second most powerful political party. It is opposed by many other parties, including the Indian National Congress, which is India's largest political organization.

Pakistan is a proposal to divide India into two separate nations on the basis of predominant religious affiliation of the population in each proposed nation. By this means the Muslim League expects to prevent the Hindu majority in a self-governing India from practising discrimination against the Muslim minority. The League formally adopted Pakistan as its goal in a resolution of March, 1940. The provinces of British India in which the majority of the people is Muslim would constitute a nation to be called *Pākīstān*. This name is coined from the Persian *pākī* "pure, devoté of the Pure or Sacred," and *stān* "country," and means "Land of the Pure." The other provinces of British India, in which the religion Hinduism and its adherents, Hindus, predominate, would be called *Hindūstān* "Land of the Hindus." The name Pakistan was originally not a political term, but a religious; it was first urged as a political ideal by a Mr. C. Rahmat Ali in 1933. The term was not used in the League's 1940 resolution, but it already had wide popular currency. It is now general in India among Muslims and non-Muslims alike.

Until this past summer Pakistan was only India's second most critical issue; first place belonged to the issue of full self-government, whether as a member of the British Commonwealth of Nations or as an independent sovereign state. But during the past summer the latter issue, after being contested between Indian nationalism and Britain for many decades, seemed to become well advanced toward solution. The Labour Government had sent a three-man Cabinet Mission to India in March to seek an agreed settlement of India's future constitution among the various important groups in the country. Such a demand of prior agreement among major parties on important constitutional questions was an old one, and had been regarded by Indians as something incapable of achievement—in what democratic country had such a prior agreement ever been effected?—used by the British as a device for perpetuating their own hold on India. Again no agreement was reached —just because of the communal issue—but the Mission gave up the principle of prior agreement and devised its own plan as an award to India, which Prime Minister Attlee read in the House of Commons on May 16 as a White Paper. The plan laid down the procedure by which India should determine her own future political status through the deliberations and decisions of her own elected representatives sitting in a constitutional assembly, and the method indicated, together with the steps since taken by the Labour Government and the Government of India to implement it, has been accepted by Indian nationalism as apparently workable. As the first of these steps, India is now being governed in effect by a completely Indian central executive, known as the Interim Government, which is to function until a new constitution can be framed by a representative Union Constituent Assembly, already elected

and scheduled to meet in December, 1946, and a new system of government inaugurated under that constitution.[1] The new document will, of course, require ratification by the British Parliament before it is effective, and it is a part of the Cabinet Mission's plan that it must be accompanied by a treaty to be negotiated between the Indian Union Constituent Assembly and the United Kingdom to provide for certain matters arising from the transfer of powers. These are preservation of the rights of India's minorities, safeguards of the rights of Indian States as these have been guaranteed by treaties with Britian, commercial and financial relations between Britain and India, and strategic concessions to Britain. These are also matters which Indian nationalism has long felt that Britain has used as an excuse to delay unduly the grant of full self-government, and nationalist leaders do not even now seem entirely free of skepticism concerning the terms on which Britain will agree to settling them in the treaty. Nevertheless, nationalism has laid them and the whole nationalist question aside for the present, to concentrate attention on communalism and Pakistan, which provide the most immediate problems for constitution-making as well as for current administration.

2. RECENT POLITICAL DEVELOPMENTS CONNECTED WITH PAKISTAN

The Muslim League, which promotes the idea of Pakistan, has a membership variously estimated at from half a million to a million and a half—it does not reveal its numbers. Small though even the larger figure may seem, it is true that the League speaks as the voice of the politically conscious part of India's over 92,000,000 Muslims. In India political consciousness is still largely confined to the bourgeoisie; the right of franchise is limited and qualified voters in British India are about 13 per cent of the population. The membership of the League is drawn from middle and upper class Muslims of British India, especially including wealthy Muslim landholders, feudal in their agrarian outlook, who are thought to provide the greater part of the League's financial support.

The Indian National Congress (or Congress Party), which is the League's chief opponent on the Pakistan issue and the whole communal question, differs fundamentally from the League in aiming to represent all Indian communities and classes, but in actual fact it draws most of its membership from the Hindus. Its direction is bourgeois, and so is much, perhaps most, of its membership, though its leaders work among the masses and often get strong mass support. Gandhi has been especially successful in this respect. Congress has been the effective agent of Indian nationalism, seeking to gratify cultural, social, and economic ends by attaining political independence. The country's leading industrialists and big business men, who are mostly non-Muslims, provide the bulk of the Congress's financial support.

In promoting Pakistan the Muslim League today is inflexible. When the League first adopted the proposal in 1940, many students of Indian affairs thought that it was a conscious overstatement of aims for bargaining purposes to wring political and economic concessions from the Hindus. But if that was ever the Muslim League's intention, it has been well modified in the past four and a half years. At the end of March, 1942, two years after the League had adopted Pakistan, when the war was going badly and the Indian political situation was steadily deteriorating, the British War Cabinet sent Sir Stafford Cripps to India with draft proposals for giving the country a new political status. These provided preferably for a United India Dominion, but at the same time opened the way for Pakistan and a divided India by conceding "the right of any province of British India that is not prepared to accept the new Constitution to retain its present constitutional position, provision being made for its subsequent accession if it so decides. With such non-acceding provinces, should they so desire, His Majesty's Government will be prepared to agree upon a new Constitution giving them the same full status as the Indian Union." In speaking of accession to the Indian Union, and thereby implying that India had yet to become a political union, this provision actually contradicted the accepted conception of India. The country already was a unitary nation, under a single government, and the provision was therefore really conceding to the various component parts of India a hitherto unrecognized right of secession. By so doing it at once took Pakistan out of the dream world and gave it the appearance of feasibility.

From the time of the War Cabinet's offer, during the remaining war years, the prestige of the

[1] The Constituent Assembly unanimously adopted a resolution on January 22, 1947, declaring "its firm and solemn resolve to proclaim India as an independent sovereign republic." No Muslim League members were present in the assembly.

Muslim League as promoter of Pakistan steadily increased. At the same time the strength of the Indian National Congress was declining under the attack of Mr. Churchill's government, which outlawed both the All-India and provincial Congress organizations, confined the leaders to the number of more than 60,000, and seemed bent on destroying the Congress as a political force. The recent 1945–1946 elections in India show the growth of the League's power. Though in the 1937 elections for the provincial assemblies, the last before those of the present year, the Muslim League was able to win only 104 seats out of the 482 constitutionally reserved for and elected only by the Muslim community, this year the League won 412 of them. The League also won 14 other seats this year, including 9 of the 10 reserved for Muslim women; in 1937 it won only 5 other seats. Again, in the elections last November to the Central Legislative Assembly, the League won all of the 30 seats reserved for the Muslim constituency. It is true that other Muslim organizations and the Indian National Congress speak for certain sections of the Muslim community, but those sections are small, and there is no doubt that the League speaks for the bulk of it.

Confirmed then by this solid support, the League and its leader, Mr. Jinnah, in the negotiations last spring with the British Cabinet Mission, demanded the grant of Pakistan as an unalterable condition precedent to any further steps leading to solution of the constitutional problem. The Indian National Congress, which is as intent on national unity as the League is on division, flatly refused to accept this, though it was willing to move from its stand in favor of a strong closely-knit central government to one with very much limited powers.

Because of the League's intransigence the Cabinet Mission in its own plan, though rejecting the Pakistan proposal in its full and complete form, has made extensive concessions to it. Two of these we may note here. The first and more basic is the narrow limitation put upon the powers of the proposed Indian Union's central government. It is to deal only with foreign affairs, defense, communications, and the financing of these subjects. All other subjects are to vest in the provincial governments. In this way the Mission thought to reduce to a minimum, if not entirely eliminate, the danger that Hindu provinces might practise discrimination against Muslim provinces. Second, the eleven "governor's provinces" of British India are to be free to form themselves into "groups." Each group may have its own executive and legislature functioning over the provinces in it and may determine the provincial subjects of government to be taken in common. Since the government of a group is not limited to the narrow range of subjects prescribed for the central union government, it may become a very compact, highly centralized, and efficient political body, in contrast to the central Union. Further the Cabinet Mission's plan puts something like grouping into operation at once, in advance of the drafting of a constitution. It divides the eleven provinces into three "sections," which if they wish may later become "groups." The three sections are to sit as such and deliberate separately from one another in the constitutional Constituent Assembly. Two of the sections are composed of provinces predominantly Muslim in population; the other consists of the non-Muslim provinces. A province may "opt" out of the section to which it is assigned in the plan when the new constitution has come into effect and the province's legislature has taken such a decision after the first general election under the new constitution. The result at the beginning of the plan's operation will be a kind of Near-Pakistan.

The Muslim League, after considerable deliberation, at first approved the Cabinet Mission's scheme; later, it withdrew from participation for specific reasons. The first quarrel was concerning the nature of the interim government, which took office on September 2. The Cabinet Mission meant this to be a coalition and to have "the support of the major political parties," and it was appointed by the Viceroy only after consultation with party leaders. The League was willing to join this government, but only on condition that it have parity with the Congress in number of portfolios, and that it also have the sole right to nominate Muslims to the government. Congress was willing to let the League have five portfolios to its own six, out of a total of fourteen to be appointed then (two to be added later), but would go no farther. It is much stronger politically than the League; it won 56 seats in the present Central Legislative Assembly against the League's 30, and in the elections to the present provincial assemblies won 922 seats against the League's 426. It therefore considers parity unfair. The Viceroy at one point proposed a government on the basis of parity, but the Congress refused to cooperate, and the Viceroy in his final set of nominations scrapped the principle. Congress also flatly refused to restrict its nominations to non-Muslims,

since it claims that it is not a communal body, like the Muslim League, but represents all types of Indians. The Muslim League once thought it had won its points. When they were refused, it considered itself to have been betrayed by the Viceroy and accused him of bad faith. In consequence it boycotted the interim government until October 12 when it at last agreed to enter, accepting the five portfolios offered it and without having won the right to make all Muslim nominations.

Further, in respect to the Constituent Assembly which is to frame India's new constitution, the League, though first agreeing to cooperate, later refused. Its present intentions have not been stated. Mr. Nehru, of the Indian National Congress and head of the interim Indian government, has indicated that the arrangement of provinces in sections for the Constituent Assembly is unacceptable to at least two of the provinces which are controlled by Congress but included in the Muslim sections, and will therefore be abrogated by them as soon as the sections meet, instead of at the later time indicated in the Cabinet Mission's plan. The League, however, has demanded that the plan be followed in its entirety.[2]

The League has apparently been hoping to render the whole of the Cabinet Mission's plan unworkable. When the announcement was made that a government would be formed even without the League's cooperation, the League endeavored to arouse the Muslim Community to "direct action" in protest. It named a day for that purpose, August 16, calling for demonstrations, which were to be non-violent. But that day and several following were marked with the bloodiest rioting in Calcutta which India had ever known. Later there were communal riots in Bombay, Dacca, and many other cities, and in mid-October in certain districts of eastern Bengal where Muslims outnumber Hindus between four and five to one. These disturbances might seem like possible opening moves in the civil war which Mr. Jinnah has freely prophesied will be inevitable if India is given full self-government without the award of Pakistan as well. The provincial government of Bengal, which is controlled by the Muslim League, has been accused by Mr. Nehru in a statement in connection with the rioting of "a sense of irresponsibility which is amazing." Many non-Muslims in India believe that the disorder is not unwelcome to Muslim political leaders as a reinforcement of their political demands. Many observers

[2] The dispute between the Congress Party and the Muslim League over the grouping of provinces in the Constituent Assembly has continued steadily since this paper was written. On December 7, just before the Constituent Assembly was to meet, the British Government issued a statement affirming: (1) that the terms of the Cabinet Mission's plan must be observed and the provinces grouped in the three sections of the Constituent Assembly as indicated; (2) that "decisions of the Sections should, in the absence of agreement to the contrary, be taken by simple majority vote of the representatives in the sections"; and (3) that "Should a Constitution come to be framed by a Constituent Assembly in which a large section of the Indian population had not been represented, His Majesty's Government could not, of course, contemplate—as the Congress had stated they would not contemplate—forcing such a Constitution upon any unwilling parts of the country." This statement produced strong, but varied, reactions in India, including bitter objection from Congress leaders. But on January 6 the All-India Congress Committee adopted a resolution in which it declared itself willing to "agree to advise action in accordance with the interpretation of the British Government in regard to the procedure to be followed in the Sections. It must be clearly understood, however, that this must not involve any compulsion of a province, and that the rights of the Sikhs in the Punjab should not be jeopardised. In the event of any attempt at such compulsion of a province or part of a province it has the right to take such action as may be deemed necessary in order to give effect to the wishes of the people concerned. The future course of action will depend upon the developments that take place and the All-India Congress Committee directs the Working Committee [of the Congress] to advise upon it whenever the circumstances so require, keeping in view the basic principle of Provincial autonomy." Opponents of the Congress describe this resolution as equivocal. Of the two provinces concerned Assam may be said to speak through its premier (Mr. Bardoloi), who stated on January 7, the day after the Congress Committee adopted its resolution, that Assam "was prepared to sit in sections in the Constituent Assembly, but Assam demands exactly what the Muslim League demands from the Union centre," and is just as apprehensive of the Muslims in a section as the Muslim League is of the Congress in the whole assembly. He also pointed out the divergence of interests between Bengal and Assam, and affirmed, "We shall therefore see that our future also will be decided as a separate unit from Bengal." The premier of the North-West Frontier Province (Khan Abdul Ghaffar Khan) also issued a statement on the same day (January 7) which, however, had little more specific content than approval of the Congress resolution and censure of Britain for continuing to complicate India's politics. The Sikh leader Master Tara Singh expressed disappointment that the Congress resolution had yielded to the British Government's interpretation; later certain Sikh leaders threatened that the Sikhs would boycott the Constituent Assembly. The radical Congress Socialists disapproved the Congress resolution as a retreat; so, too, did the Forward Bloc, which stated on January 14 that it would boycott the Constituent Assembly. The Muslim League has not yet indicated whether or not it will participate in the Constituent Assembly; the matter may be decided at a meeting of the League's Working Committee scheduled for January 29. [W.N.B., January 26, 1947.]

also question the League's motives in finally entering the interim government. It is suggested, though without confirmation, that the purpose is not to obtain for India a successful administration, but rather to sabotage the present government's All-India efforts and so promote the Pakistan effort.[8]

3. NATURE OF THE PAKISTAN PROPOSAL

What part of India is claimed for Pakistan? For a long time the League did not define it. In its 1940 resolution adopting Pakistan the League merely stated that "the North Western and Eastern Zones of India" should constitute "independent states in which the constituent elements shall be autonomous and sovereign." Various specific delimitations were offered unofficially by supporters of Pakistan. Many went outside the boundaries of India to include Afghanistan. Hindus frequently suspect that the real motive behind Pakistan is to establish Muslim rule over all India by force, and Muslims often make statements which give some basis for that fear. For example, in April of this year Mr. Suhrawardy, of the Muslim League, then premier designate of the Bengal province, was reported in *The New York Times* to have said to the convention of Muslim legislators of Bengal, "The Muslims want to be the ruling race in this subcontinent" (that is, in India). Soberer claims are made officially by the League and its president, Mr. Jinnah. They demand six provinces of British India. Four of these are in northwest India: the three "governor's provinces" of the Punjab, the North-West Frontier Province, and Sind, and the "commissioner's province" of Baluchistan, all of which are predominantly Muslim in population. The other two are governor's provinces in eastern India: Bengal, which is about 54 per cent Muslim, and Assam, which is only about one-third Muslim. The inclusion of Assam is defended on the ground of its weakness and isolation from the rest of India. These six provinces contain about 62 or 63 per cent of India's Muslims and about 16 per cent of the non-Muslims. Indian States, such as Kashmir, which are predominantly Muslim and by reason of geographical position seem eligible for Pakistan are not officially claimed since constitutionally the States have the right to dispose of their own future. Hindustan would be much larger than Pakistan, richer in resources, and contain almost twice the population.

There are certain obvious and weighty objections to dividing India into two nations. First, the minority problem, which Pakistan is alleged to solve, would still exist. In Hindustan there would still be Muslim minorities and in Pakistan there would be non-Muslim minorities, which are already protesting. The Sikhs, for example, who live chiefly in the eastern Punjab, are bitterly opposed to Pakistan or any system of grouping that looks like it. Again, western Bengal, containing India's premier city Calcutta, is predominantly Hindu. Mr. Jinnah has indicated at various times that provincial boundary lines might be redrawn, but it is doubtful that he would consent to the loss of Calcutta. Still again, the recently elected legislatures of Assam and the North-West Frontier Province, the latter being the most solidly Muslim province of all India, are Congress controlled and as such are opposed to the inclusion of those provinces in Pakistan. Second, there are certain administrative and economic objections to Pakistan. India is marked off from the rest of Asia as a geographical unit, and her internal political and economic structure is so interdependent in its geographical parts that it cannot be divided without serious detriment to the parts as well as the whole. Administration of the railroads, postal and telegraph services, and probably some other departments of national life, which are now organized on an all-India basis, would be inefficient in a divided country. Economically, the proposed Pakistan would contain some weak members: Baluchistan and the North-West Frontier regularly require financial assistance from the rest of India. Division would also seriously impair India's industrial development. Third, the defense of India would be severely imperilled. The two parts of Pakistan would contain India's two weak frontiers, and defense in depth would be difficult if not impossible. Fourth, the two parts of Pakistan are separated from each other by a gap of 700

[8] Hindu-Muslim tension has been continuous since this paper was written. The most serious situation developed in the Punjab late in January. On January 24 the Punjab Provincial Government (a coalition dominated by Congress) outlawed the Muslim League's National Guard, organized in 1937 to keep order at meetings, but in the past two years assuming a military aspect, and on that day and the next arrested many Muslim leaders in the Punjab, including sixteen members of the Punjab Legislature, former high officials in the Government of India, and the president of the Punjab Muslim League. The Punjab Government also declared illegal a Hindu youth organization (Rashtrya Swayam Sewak Sangh). Sympathetic Muslim demonstrations against the action of the Punjab Government are reported from many places in India outside of the Punjab. [W. N. B., January 26, 1947.]

miles, across which they could communicate only by the courtesy of Hindustan. Finally, the Indian States would have to adjust themselves to two independent Indias, instead of one, and even in the latter case the problem is bound to be very delicate. These considerations were either directly advanced or implied by the Cabinet Mission in rejecting the two-nation proposal for India. They are hardly subject to any dispute.

In view, therefore, of the serious disadvantages inhering in the proposed division, which would fall upon Muslims as well as Hindus, it may well be asked why the Muslim community wishes it. We shall now seek an answer to that question, and in doing so we shall consider the two communities' basic cultural and economic differences, and the political rivalry which makes the Muslims apprehensive for their future.

4. CULTURAL DIFFERENCES BETWEEN MUSLIMS AND HINDUS

The cultural differences between Hindus and Muslims appear to political leaders of the two communities in contrasting ways. Mr. Jinnah, president of the Muslim League, says that the differences are not merely those of the theology. Hinduism and Islam, he affirms, are more than two different religions; rather, they are two different civilizations—so numerous and so profound does he consider the antitheses—and, therefore, the two communities are more than a majority and a minority within a united India; they are two separate nations. But Mr. Jawaharlal Nehru, chief spokesman for the Indian National Congress, himself a Hindu, in viewing the communal problem, says in his recent book (*The Discovery of India,* 1946) that the native Hinduism of India and the intrusive Islam have become so well assimilated to each other that today they are only modifications of a common civilization. And Sir Tej Bahadur Sapru, a distinguished elder statesman of India, and a Non-Party Conference committee which he recently headed, called the Conciliation Committee, in its report on *Constitutional Proposals* (published in December, 1945) take the same position. Mr. Jinnah emphasizes the contradictions between the two communities; Mr. Nehru and Sir Tej Bahadur, the correspondences.

In these two contradictory attitudes is illustrated the most fundamental of Hindu-Muslim divergences. Islamic civilization is centered around the religion of Islam, and one of the most characteristic features of that religion is the demand for doctrinal and cult uniformity. Only one view of God is acceptable, namely, as Allah; only one series of revelations concerning Him exists, namely, that of the prophets, of whom Muhammad is the last and the "seal"; only one book contains the divine message, the Koran; only one standard of duty lies open to man, submission to this revelation as a Muslim. But the religion of Hinduism, which is the core of native Hindu civilization, does not demand such uniformity, even as an ideal; rather, it is latitudinarian and tolerant. With orthodox sanction and practice, Hinduism permits an unlimited variation in belief concerning the nature of God and a corresponding diversity in cult and standards of human behavior.

Hinduism believes that mankind is incapable of achieving uniformity because human beings are inescapably affected by all their actions (*karma*) in previous existences which give them even at the instant of birth unequal endowments of intellect and spirit as well as unequal economic and social position. Thus it sanctions the institution of caste, with its undemocratic implications. But orthodox Islam democratically views all mankind as born equal; it considers, in fact, that all infants are born Muslims; it is their misguided parents who turn them into Christians, Jews, Hindus, Buddhists, Sikhs, or others. Hinduism, therefore, logically prescribes different duties and different standards of action for different castes. It is, from the point of view of Hinduism, unrealistic to expect human beings, so unequal in their capacities, to hold the same dogmas. Except in the case of the very few rare souls who comprehend absolute truth, everyone is partly right and partly wrong, though in differing degrees.

What Hinduism demands is that, since things are so, people of one persuasion should not interfere with people of another but leave them alone in their relative ignorance or wisdom and in the activities corresponding to their limitations. Proselytism is useless and troublesome; it may even be harmful. In some future existence an individual, if he performs adequately the duties of his present state, may repair his present spiritual inadequacy and win nearer to supreme knowledge and truth. But Islam, with equally logical deductions from its premises, believes in missionary enterprise and conversion of the infidel and erring to the single revealed standard which it recognizes.

These contrasting attitudes of traditional Hinduism and Islam are not without exceptions in their own communities. Many Muslims, especially today in the Near East, take a wider view of

civilization and even of religion than strict and literal orthodoxy would admit; and there are in India many illiberal and overly dogmatic Hindus who are intolerant of sectarian belief other than their own and scornful of those outside their own narrow group. Yet the basic contrast remains true. Hence Islam makes a bifurcation of civilizations into the Islamic, which fundamentalist Muslims regard as God-inspired and the only true and defensible civilization, and all other civilizations, which are by nature heterodox and false. But orthodox liberal Hinduism may easily admit all cultures now present in India to be reconcilable as merely variations within a single great civilization. Cultural separatism and domination leading to the extinction of any conflicting cultural features is a natural corollary of the Muslim position. Cultural amalgamation is equally a corollary of Hindu theory, and has given to Hinduism a capacity of absorbing foreign cultural elements which has been evident ever since Grecian civilization first touched India in the fourth century B.C.

Related to this difference in basic outlook upon life is a difference in the cohesiveness of the Muslim and Hindu communities. With the high importance which Muslims attach to dogma and their generally democratic social order, the Muslims have developed a strong sense of community. This expresses itself to the eye in congregational worship in the mosque. There a great courtyard may be filled with a thousand faithful worshippers, whose voices and bodies rise and fall as one in the unison of prayer. Any similar phenomenon is unknown in Hinduism. When a Hindu goes to a temple, he worships alone and in undertones. Many temples are not open to all social groups. Caste has split the Hindu's society and intellectual freedom has individualized his religion. His human Utopia is a state of philosophic anarchy; the Muslim's is the well-drilled regiment. The sense of membership in a community, despite sectarian differences, gave Islam the drive that carried it, within 110 years after the Hegira (A.D. 622), across North Africa and into Spain and France in the west and as far as the river Indus in the east. The Muslim consciousness of community is especially strong in India, where the Muslims are a minority. There, in spite of sectarian theological and political differences, it has given them a power of aggressive action quite out of proportion to their numerical strength.

Again, closely related to the fundamental contrast between Islam, with its unitary and dogmatic conception of life, and Hinduism, with its multiple and relative conception, is a difference concerning the relationship of the state and religion. It is a general Islamic dogma that Muslims should be governed only by Muslims; Hinduism has no such religious criterion of rulership. The Muslim theory, in its orthodox and extreme form, leads to a view of the state as strictly a theocracy, which makes Islam less a state religion than a religious state. Muhammad regarded himself as the "warner" of his people, calling them to submission (*islām*); their duty was to become submissive (*muslim*) to Allah's will. The function of warner was considered a function of the state, to make conversions to the faith the state's highest purpose. That is why Islam has been promoted by military and political means as has no other religion.

The early Muslims viewed the world as composed of two hostile military camps. One was the "abode of Islam" (*dār-ul-islām*) where the true faith was established; the other was the "abode of war" (*dār-ul-ḥarb*) where Islam was not established and false doctrine prevailed. A ruler of the faithful was under obligation to convert the abode of war into the abode of Islam. This he might endeavor to do by making a demand of conversion upon the unbeliever state. If the demand were accepted, all was well; but if not, then he must wage a holy war (*jihād*) of compulsory conversion. The conquered were to be treated in two ways according to their previous religious condition. "People of the Book"—Jews, Christians, Magians, Sabaeans—whose scriptures are considered by Muslims to be in the correct line of revelation though now corrupted, had the choice of becoming Muslims or of accepting "protection" and paying a poll tax (*jizyah*). If they refused conversion, their lives were spared but they could not enjoy citizenship. People who were not of the Book had either to become Muslims or be put to death. Obviously, the harsh and extreme application of Muslim theory was impracticable where the conquered folk was stubborn yet necessary to supply labor for the true believing conquerors. For this reason conquered people, including many Hindus, were often allowed to keep their religion and their life, though it might be with impoverishment, humiliation, or even slavery.

The Hindus have no such theory of the state. They do not regard it as divine will that all people should be Hindus under a single rule. Whenever a mythical king is represented as forming a universal empire, "uniting the world under a single umbrella," the feat is acclaimed as evidence of his superior individual merit accumulated by good

deeds in previous existences as well as in this, but not as in fulfillment of some cosmic purpose. Rather the cosmos operates by great metaphysical forces, acting like mathematical components, which produce alternating rise and fall, creation and destruction. The relationship of kingship to religion is associated with the idea of caste. Every person is born to perform some function which fits into the universal order. This function is his caste duty; the degree to which he fulfills it is the degree of his success in life. A person born in the ruling caste has ruling as his duty, and this consists in enforcing righteousness, administering the affairs of the kingdom in the interests of his subjects, and protecting from molestation the holy men who are performing their sacred rites. Failure will bring disaster upon him and the realm. Conquest or extension of the Hindu faith into new territory is only incidental, though perhaps desirable, in furtherance of his personal ambitions.

To the traditionally educated Hindu the Muslim theory that state and religion are identical is illogical and untenable. When the Muslims overran India and made forcible conversions, as they often did, the Brahman regarded the conquerors as, in this respect, irrational and mentally immature.

Other lesser, yet important, cultural differences separate Hindus and Muslims. The Hindu institution of caste, wherein all men are born to graded places in society, with the Brahman on top as "a god on earth" and the outcaste Untouchable at the bottom, is repugnant to Islam, with its democratic doctrine that all men, at least all Muslims, are equal. Again, Hindus decorate their temples profusely with images of gods, human beings, and animals, and use idols in worship to call a deity to mind. But the Koran strictly forbids the representation of any animate objects, and the Muslims destroy the Hindus' temples and images. The Hindu attaches a peculiar sanctity to the cow and considers cow-killing only less heinous a sin than Brahman-killing; the Muslim regards the cow as legitimate food or sacrificial victim and when he can do so with impunity will slaughter the sacred animal. Hinduism uses the native Indian Sanskrit as its classical and sacred language and writes its books in native Indian scripts; Islam uses the imported Arabic and Persian languages and writes in the Perso-Arabic script. Hence the two, with only rare exceptions, have not read, and cannot read, each other's books.

With the two communities possessing fundamentally different outlooks on life, the Muslim has generally felt it useless to understand the beliefs and social practices of the Hindus, and the Hindus, on their side, have been prevented by caste rules from marrying outside their endogamous groups or even interdining and so have been denied much social intercourse, otherwise possible, which would have helped to bring understanding and mutual toleration.

These cultural divisions between Islam and Hinduism, accentuated by over twelve hundred years of historical conflict, have led many besides Muslims to look upon India as lamentably but inevitably a two-nation land. But there are entries to be made on the credit side of Hindu-Muslim relations, showing some degree of cultural assimilation and so bearing upon the present Pakistan issue.

The most important of these, and one which leaders of the Indian National Congress often stress, is the fact that the Hindus and the Muslims in each locality of India belong to the same racial and ethnic stock. Islam spread in India by conversion rather than by immigration. And these converts were made not so much by force, though force was often used and the memory of that is bitter among Hindus, as by missionary effort among the lowest in the Hindu social and economic scale, who found relief from many disabilities in accepting Islam. In every part of India the indigenous Hindus and Muslims are alike physically; they can be distinguished only by externals, such as dress, treatment of facial hair, sectarian markings, customs of eating, drinking, or other.

Moreover, in every locality both parts of the population speak the same language. In the case of language there is a very special condition relating to Hindustani, which is India's great lingua franca. This speech is of native Indian, that is Hindu, origin, being basically a dialect current in and near Delhi. It became a lingua franca because Delhi was for over five hundred years the Muslim capital in India, and its dialect became the common speech of the Muslim armies which carried it with them in their conquests wherever they went. On a high literary level Muslims introduce into the language many words of Persian and Arabic origin and write it in the Perso-Arabic script; this variety of Hindustani is called "Urdu." Similarly, Hindus in their high literary form of Hindustani use many loanwords from Sanskrit and write in the native Indian Devanagari script; this variety is called "Hindi." Today Hindustani, in both of its forms, is acceptable over large areas where the

ordinary daily speech is uniform basic Hindustani; in many other parts of the Hindustani area, one or other of the two literary varieties is preferred. Outside the regions where Hindustani is the common speech there are many people, even in remote southern India, who understand a greater or less amount of the language. The Indian National Congress now advocates that it be taught everywhere in India as a "second language" to supplement the local vernacular.

Socially, too, there has been occasional assimilation of the two groups in some localities, for example, in using similar wedding ceremonies and in sharing each other's religious festivals. Muslim dress has affected, though seldom completely supplanted, native Hindu middle class costume. The Muslim habit of secluding women in many regions became a practice of those Hindus who could afford it—the custom is now rapidly declining among both communities. Caste, though contrary to Muslim doctrine, nevertheless exists among Muslims on the lower economic levels, which contain groups that could not entirely rid themselves of caste feeling when accepting conversion. On those same levels, that is in the villages among peasants and artisans, the two religious groups ordinarily live in mutual toleration unless aroused by agitators. They seldom know the bitter communal strife existing among the middle classes. The Hindu and Muslim masses have the same occupations, live very much alike, and all being illiterate are spared misunderstanding on the intellectual level.

But even on that latter level there exists a body of common material, as in the traditional mathematics, astrology, medicine. For several centuries, particularly during the sixteenth and seventeenth, Muslims translated Sanskrit works into Persian, which probably were not read much, yet showed a tendency toward community interrelationship. During that same period both communities had a certain amount of common vernacular literature. In architecture native Indian and imported Persian have blended to produce common forms frequently employed in both Hindu and Muslim secular buildings, while in temple and mosque construction there has been exchange of many individual structural and decorative elements. Painting as practiced by both communities during the past three centuries has also been a fusion, in varying degrees in different localities, of native Indian and Persian. Today Hindus and Muslims often cherish, instead of destroy, each other's cultural monuments, notably in the Muslim states of Hyderabad and Bhopal.

Even in religion there have been approaches to each other. Muslim mysticism, that is Sufiism, though unpalatable to Islamic orthodoxy, makes its adherents and Hindu mystics mutually intelligible. Compromise religions have been preached by great teachers who have drawn ideas from both Hinduism and Islam. Kabir (1440–1518) was one; there are still sects bearing his name; another was Nanak (1469–1538), the founder of Sikhism. The great Mughul emperor Akbar, who ruled from 1556 to 1605, endeavored also to establish a synthetic faith, but probably doomed it by putting himself at its head; it perished with him. Generally the reconcilers of the two faiths have done less in bringing them together than in creating new sects to complicate still further the varied array of India's religions. Nevertheless their efforts show that many Indians can accept religious amalgamation. The compromise faiths illustrate the manner in which Hinduism has often eliminated its rivals. It wins them over and absorbs them by accepting their teachings, though with adaptation and modification. Islam, however, has so far shown no signs of yielding to this process.

Finally, the two communities have much of common history. Rulers of one faith have frequently made alliances with rulers of the other against rulers of their own faith. Muslim rulers have often used Hindus as civil administrators and generals, and Hindus have done the same with Muslims. During the British period in India the hereditary rulers and leaders of each group alike have been deprived of their powers and inheritance by the intruding Europeans, and both communities have suffered as their handicrafts have been put in competition with western machine industry. It is to their joint interest as Indians, says nationalism, to unite now in expelling the foreigner.

Hindus and Muslims occupy, and will continue to occupy, say the political conciliators, the same country; neither can, or should hope to, eliminate the other. They cultivate the same land; eat the same, or almost the same, food; depend upon the same climate for their livelihood; are heirs to the same cultural remains in India, whether those are Hindu, Buddhist, Jain, Muslim, or some other; must utilize the same natural resources of the country to enjoy its future. All these considerations appear to many Hindus and some Muslims as the adequate basis for a common nationalism and common effort, which will be successful only in an India that is a single state, not two.

5. ECONOMIC DISPARITY OF THE TWO COMMUNITIES

The cultural differences between Hindus and Muslims might by now have been overlaid and become negligible in their effect upon national life if they had not been supplemented by economic disparities and political rivalries. The most influential of these have come into existence during the period of India's contact with modern Europe, especially Britain.

An accident of geography first had a part in creating some of these latter differences. Because the Muslims had entered India from the northwest and were concentrated in the north and away from the seaports where the British entered, it was the Hindus, living in and near those ports, who first profited economically from the British commerce and first took advantage of the western education when it was introduced. The Muslim upper classes remained in their own areas as rulers and landed aristocracy, but it was the Hindus who developed a new bourgeoisie. By the time of the Indian Mutiny (1857–1858) the Muslim community was already at a disadvantage in having only a small middle class against the relatively large Hindu professional, clerical, and commercial groups, and in having accepted much less than the Hindu community of modern learning and education. This condition persists down to the present.

There was also in the nineteenth century a political situation contributing to the Muslim disadvantage. The Indian Mutiny was considered by the British a responsibility of the Muslims. The titular head of a freed India, as the Mutiny would have made it, was the Mughul emperor. He was the hereditary successor of the Great Mughuls, the last of whom was Aurangzib (died 1707), and the position had carried no real authority for ten successive so-called reigns. Nominally, however, he was suzerain in the old empire, even over the East India Company. Around his shadowy figure the mutineers had assembled their forces. Because of this fact, the British, after quelling the Mutiny, laid the heavier part of the penalty upon the Muslims. It was around a decade later before the British lifted this discrimination.

During the second half of the nineteenth century the Muslim community contained the larger part of India's dispossessed and unhappy great. It no longer had the political supremacy enjoyed under the Mughuls in the sixteenth and seventeenth centuries, whose power had been destroyed by the Hindu Marathas and the Christian British, both of them infidels. In the changing economic and adminstrative order also the Muslims' position had deteriorated; the method of revenue collection was being readjusted; native handicrafts were declining under the impact of western industrialized commercial penetration; the system of transportation was being revolutionized through the building of railroads; and in some measure capital was being employed to construct an Indian textile industry. Political theories were being revised in consequence of new western social, economic, and political doctrines. While the Muslim community still dreamed of its past, resented the present, and hoped to reestablish its prestige in the future along the ancient lines, Hindus were sharing in India's modernization. It would be erroneous to say that the Hindu community as a whole was progressive, but many Hindus were taking advantage of India's new condition. Hence, the greater number of government posts open to Indians fell to Hindus, and the prizes of business were theirs too. By the time the century was three-fourths past, the old Muslim landlords, who held their position under government title, were still in possession of large sections of Bengal, Bihar, Orissa, and the United Provinces, but in other respects Hindus had the better status. It was inevitable that this situation should produce inter-community middle-class jealousy. Since the Muslim economic and educational inferiority still continues, so also does the jealousy.

6. COMMUNAL REACTIONS

The Muslim reaction in the nineteenth century to the community's inferior position was twofold. On the one hand it was religious, puritanical, fundamentalist; on the other, it was secular and modernist.

The religious and fundamentalist reaction was the older, and consisted of Wahhabiism. This movement originated in Arabia in the late eighteenth century, and its ideas, though not its name, came to India early in the nineteenth century. They have given rise to such organizations as the Ahl-i-Ḥadīth ("People of the Traditions") and Ahl-i-Qur'ān ("People of the Koran"), which the Indian Census returns as sectarian groups. Wahhabiism has as its essence the cry of "Back to the Koran!" It strives to eliminate from Islam everything which it considers an innovation (*bid'a*) since the time of the Prophet, such as domes and cupolas on mosques, paintings, musical instruments. It has tried to restore the holy war. In India during the first half of the nineteenth century the move-

ment was widespread. It attacked all elements which Indian Islam had adopted from Hinduism and all the features of modern life which Muslims were inclining to accept. Western learning and culture were, of course, included. The result was to retard progress of the Muslim community and foster strife between it and the Hindus. But, since the Wahhabis were mostly poor, the movement assumed also something of the aspect of proletarian unrest, and as early as the 1830's was alarming the Muslim middle classes, among whom arose later the secular and modernist effort to restore Muslim prestige.

The prophet of this other movement was Sir Syed Ahmad Khan (1817–1898). He was one of the most influential of Indian Muslims during the nineteenth century. His philosophy was aligned with that of Islamic modernists in the Near East, particularly in Egypt, who passed beyond the old dogmatism. They felt that the holy Koran applied to all peoples at all times. The two camps of Islam and War, they taught, were not so much political conditions as states of the human heart. Muslims should spread Islam by precept and example rather than violence; the true teaching of Islam was love for all fellow human beings. The political consequence of this teaching was that Islam was not to be an international state under the Muslim banner of religion, but a state of mind and soul among Muslims, who might be rendering fealty to many national governments, including those that were non-Muslim.

Sir Syed was loyal to the British rule in India and did not favor political nationalism as fostered by the Congress. He had been loyal during the Mutiny; he did not share the Muslim resentment of the British repression of the Mutiny. He wished that rule perpetuated, since under it Hindus and Muslims had the privilege of living according to their own religious law. He pleaded publicly for freedom and independence of thought, and the application of historical criticism to Muslim tradition. He preached a liberal philosophy to the Muslim community, and he had a keen intelligence and a winning personality to enhance the effect of his message.

As part of his program he tried to separate Muslim education from the traditional religious instruction so as to give it a secular character, utilizing modern scientific and historical information. In 1875 he founded an institution known as the Muhammadan Anglo-Oriental College at Aligarh, which immediately was successful, and in 1920 was chartered as the Aligarh University. It is today the leading force in shaping Indian Muslim opinion. But, though Sir Syed believed in inter-community cooperation of Hindus, Muslims, and others, the character of his institution today is communal, and operates against that ideal. Liberalization of India's political system, with increased opportunity for Indians in public life, has helped produce this result by giving wider scope for inter-community rivalry. Today at the Aligarh University anti-Hinduism is expressed in modern terms and applied to modern issues; though religion is not emphasized, secularism is promoted in the economic, social, and political spheres. There are efforts elsewhere in the Muslim community to give modern education without a communal flavor, but these have received no great support. Both the religious and the secular cultural reactions of the Muslim community in the nineteenth and twentieth centuries, therefore, have tended to promote communalism.

Muslim communalism is also in part a reaction against Hindu communal activity. During the last quarter of the nineteenth century and continuing into the present there have been a number of Hindu efforts to compensate for lost Hindu prestige in the political, scientific, and industrial spheres by claiming a superiority in religion and morality and therefore to Islam, Christianity, and the modern West. This religious chauvinism has often entered into politics.

In Bengal, which is the most advanced province of India, the revival of Hinduism, first against Islam and then against the British, had a conspicuous place in literature. One of the most influential authors was Bankim Chandra Chatterji (1838–1894) who voiced the sentimental attachment that was growing up for India as the mystic Mother threatened by non-Hindu aggression and needing the defense of her sons. His most famous work is Ānandamatha, built around an anti-Muslim theme and now also interpreted as anti-British, which contains a Sanskrit hymn *Bande Mātaram* ("I worship the Mother"), the Congress Party's national anthem today. The Bengali Hindus were the first to develop modern Indian nationalism.

On the other side of India, in the Bombay Presidency (now called Bombay province), the Marathas, who had shattered the old Mughul empire in the eighteenth century, had a fiery Hindu nationalist leader in Bal Gangadhar Tilak (1856–1920), who aroused violent sentiment in favor of "cow protection" and other Hindu dogmas, and therefore clashed with the Muslims. His movement contributed powerfully to the growth of national-

ism and specifically of Congress, which he controlled for a time.

In the north, in the Punjab, there has been centered during the present century the chief activity of the Ārya Samāja, a fundamentalist Hindu revival society founded in 1875 by Dayānanda Sarasvatī (1825–1888). He had romantic and impossible ideas about the early Aryans in India and a violently combative attitude toward non-Hindus, especially Muslims, on the subject of cow-killing and other matters of religious dispute. The Arya Samaja, differing from usual Hindu practice, promoted reconversion of Muslim groups to Hinduism under the guise of "purification" (*śuddhi*), and in the 1920's and 1930's this led to considerable bloodshed. The Arya Samaja was for a time directly active as a political body, but its members now mostly adhere to Congress.

In southern India, in the Madras Presidency, was located the headquarters of the Indian section of the Theosophical Society, which was founded in America by Mme. H. P. Blavatsky in 1875 and taken to India by her in 1879. In that society in India there arose to prominence Mrs. Annie Besant (1847–1933), who gave the organization a political turn. The Society had constituted itself a defender of all native Indian religions as having a common and harmonious message of absolute truth, provided they were given a secret "esoteric" interpretation. There was a corollary that a country supreme in religion should not be subject politically. Mrs. Besant was the leader in the foundation in 1898 of the Central Hindu College in Benares, now the Benares Hindu University, which for long was directed by Pandit Madana Mohana Malaviya, a prominent Hindu conservative and for some years head of the frankly Hindu communal political organization known as the Hindu Mahāsabhā. Mrs. Besant founded a political party in 1916, which continued active until late in the 1920's; her followers are now mostly in the Congress.

Opposed to the Congress today as well as to the Muslims is the Hindu Mahāsabhā founded early in this century, but active since 1928 as an organ of ultra-orthodox conservative Hinduism, which looks forward to a Hindu-ruled India, and advocates the use of "steel" against Muslim opposition.

Even the Indian National Congress, though organized in 1885 as a secular body interested in social reform, has had periods when Hindu communalism appeared prominent among its membership. There have also been other times when its leadership, though anti-communalist, nevertheless had so strong a bent toward Hinduism that it inspired Muslim distrust. Since 1920 the most powerful single figure in Congress has been Gandhi, who, though a great political leader, is even more deeply concerned with religious and moral issues. He won his hold on India's masses, not yet equalled by any other Indian leader, through his reputation for saintliness and his linking of political issues with Hindu ethical teachings. His personal and public philosophy center around the doctrine of non-injury of living creatures (*ahiṁsā*), which he terms "non-violence." He applies it particularly to the cow, which he calls a "poem of pity," and when he asks for Hindu-Muslim unity, he urges the Muslims to honor that principle. The request seems no more reasonable to them than it would to most Christians. Throughout the Congress membership there is a great deal of communal anti-Muslim feeling, though it is rebuked by word and policy of such leaders as Nehru. The rank and file are often indifferent, if not actually hostile, to Muslim interests; progressive leadership has not yet won them away from communal speech and deed.

The Muslim minority is, of course, sensitive to every anti-Muslim sentiment which comes from Hindu sources, whether officially from the Hindu Mahasabha or unofficially from individual members of Congress. By force of the political system of India the Congress party is practically a Hindu party, as we shall see in the next section of this paper, and the Muslim fears are therefore directed against that party. Because they are the minority, Muslims fear more than do Hindus the threat of communalism to their future security.

7. POLITICAL COMMUNALISM

The growth of Indian nationalism during the past eighty years has increasingly taken the clash between Muslims and Hindus into politics. Intercommunity relations became critical in 1905 over the partition of Bengal. At this time the Governor General (Viceroy) of India, Lord Curzon, announced that in the interest of administrative efficiency the then large and unwieldy province of Bengal was being divided into two parts. The eastern part of the province was combined with Assam to form a new province called "Eastern Bengal and Assam." The remainder of Bengal, which at that time included the present provinces of Bihar and Orissa, was to be the province of "Bengal." This decision pleased the Muslims, because the new province of Eastern Bengal and Assam was predominantly Muslim in population,

and the province would therefore be Muslim. But the Hindus were aghast; they felt that their beloved province, the largest, richest, and most progressive of India, was being violated before their eyes. The real reason for the partition, they averred, was not administrative efficiency so much as a desire to circumvent the rising nationalism of the Bengalis. They were vehement in their demands for revocation of the partition, and the arguments inescapably took a polemical turn of Hindu versus Muslim.

The Muslims were justly fearful that the Hindus might succeed in having the partition reversed—it was reversed in 1911—and to preserve the partition as well as generally to promote Muslim interests, some of the community leaders organized the Muslim League. Among the League's specific aims one was to secure for Muslims a due share of government posts. Another was to give the Muslim community a political organization; for it was apparent that India would soon be granted the right to elect some of the members of the provincial councils—the right was later defined in the Indian Councils Act of 1909, commonly known as the "Morley-Minto Reforms." Other original objects of the League were to promote loyalty to the British government and to place Muslim "needs and aspirations before the government in temperate language."

It was the Morley-Minto Reforms themselves that really inaugurated modern Indian political communalism. In giving the country a limited form of representation in provincial Legislative Councils these reforms introduced the principle of "communal representation" with separate electorates and weightage of representation for minorities. By that system legislative seats and political appointments are apportioned among the general constituency and a number of special constituencies, most of which are defined along communal lines. Thus, Muslims have their own representatives, for whom only Muslims vote; Sikhs have representatives, for whom Sikhs vote. So, too, Indian Christians, and some other groups. The general constituency corresponds generally with the Hindu community. When this system was introduced, its sponsors stated that it was meant to solve the communal problem; instead it has only intensified it. From time to time every minority has increased its demands for weightage in representation and appointments. The Hindus have resisted these demands, but they have been compelled to concede more and more. The chief dispute has been with the Muslims. The communal conflict has been almost continuous, with only an occasional interruption, as in 1919–1922 when the Indian National Congress and the Muslim League joined forces against the British over the removal of the Turkish sultan from the position of Caliph. In the two constitutions granted India after the Morley-Minto Reforms, namely those of 1919 and 1935, the principle of communal representation was extended instead of curtailed.

Communal representation with separate electorates has become the most poisonous single feature of Indian politics during this century. It has watered the ground of the Hindu-Muslim cultural and economic differences and done more than anything else to raise out of the general mistrust the great communal hostility and the specific demand for Pakistan. The recent British Cabinet Mission realized this fact, and in its plan eliminated as much of the system's operation as it could, but it could not eliminate it entirely. The only way the Mission saw of creating the Indian Union Constituent Assembly for drafting the new constitution was to utilize as an electoral body for selecting the members of the Assembly the new Provincial Legislative Assemblies, which were elected (1946) under the existing constitution on the basis of communal representation. But the Mission took two steps to improve the situation. It reduced in the Constituent Assembly the number of constituencies to three, that is, general, Muslim, and Sikh, and it threw overboard entirely the principle of weightage; each community is to have only proportional representation.

The political issue between Muslims and Hindus became especially bitter during the years 1937–1939, when provincial governments were established under the terms of the 1935 constitution. The Congress was victorious and established ministries in seven of India's eleven provinces and led a coalition ministry in another. Congress, perhaps tactlessly in the circumstances, operated on the principle of party homogeneity in establishing its ministries, and maintained an overall direction of them under a central "high command." The Congress ministries remained in office until October, 1939; then they resigned because India had been taken automatically into the war without consultation of her elected representatives and constitutional reform had been declared postponed until after the war. The League had complained that the Congress ministries had used their power to discriminate against the Muslim community, and when the ministries resigned, the League proclaimed and celebrated December 22 as a "Day of

Deliverance" and has continued to commemorate the day each year since. It thanked God in the name of Muslims for "freeing them from the oppression of the Congress ministries" and recited a list of "atrocities" committed by the ministries under the direction of the high command. The chief charge was that the ministries excluded Muslims except those belonging to Congress, whom the League considered renegade and unrepresentative. Other atrocities included the use as a national language of the "Hindi" variety of Hindustani, rather than the "Urdu," employment of the Congress flag as the Indian national emblem, and adoption of the Hindu song *Bande Mātaram* as the national anthem. The League opposed the Wardha Scheme of Education, fostered by Gandhi and supported by Congress, as parochial, communally Hindu and neglectful of Muslim interests. It also alleged discrimination against Muslims in public office, deplored the promotion of Congress propaganda among the Muslim masses, and protested against the appointment to political positions of Muslims belonging to the Congress party.

The tension was enhanced by the communal and anti-Muslim activities of the Hindu Mahasabha, which on its side was dissatisfied with the Congress for being too conciliatory of the Muslims. Later, during the years 1942–1945, while the Churchill government kept the Congress leaders in detention, the Mahasabha assumed a prominence far beyond its real importance, for it is supported by only a very small part of the Hindu community. In the recent (1945–1946) elections it was badly defeated—for example, it won not a single seat in the new central Legislative Assembly, and only three of the 1,585 seats in the provincial assemblies.

Such potent rivalries as those growing out of the system of communal political representation create constant tension between the Muslim and Hindu communities. Very slight provocation will cause the relationship between the two to snap, as when a Hindu wedding procession passes a mosque and fills the air with music, which the Muslims consider a sacrilege. Similarly, Hindus are enraged when Muslims kill a cow. Riots and murder may follow, until the police or troops can restore order.

The Muslims have a genuine alarm that their community will not be able to maintain itself against the Hindu, which during the millennia of history has quietly absorbed many other opponents, some of them intruders from outside India, some rebels from within Hinduism itself. They fear that their faith will perish in the land, and they and their descendants be reduced economically and socially. Their attention is kept focussed on the religious issue; their leaders have been slow in evolving a social or economic program for the community; they offer little more hope than vague benefits to be derived from the safeguard of establishing the religiously motivated state of Pakistan. This is the meaning Muslims give to nationalism, and generally they have preferred in the past an India under Britain to a free India which might be dominated by the Hindus. Political activity they see as their rivals' most potent political weapon for their oppression; they make it, therefore, their own chief weapon for community protection.

Much of the strength behind Pakistan comes from the personality of Mr. Muhammad (or Mahomed) Ali Jinnah, head of the Muslim League. He was born on December 25, 1876, in a small and unorthodox Muslim sect, and during the first forty-five years of his life had no reputation for Muslim piety or special interest in his community —in this respect he stands in contrast to India's other great Muslim political figure, Abul Kalam Azad, who during the war years was president of the Indian National Congress and is considered a man of outstanding Muslim learning and religious character. Mr. Jinnah chose the law as his career, and entered politics early in this century. In 1906 he was secretary to Mr. Dadabhai Naoroji, a Parsi, who is known as "the grand old man of Indian politics" and at that time was serving his third term as president of the Congress. In 1910 Mr. Jinnah, then prominent in the Congress, became a member of the Imperial Legislative Council, and was already on record as a progressive anti-communal Muslim. He condemned the principle of communal representation, which had been accepted in the Morley-Minto Reforms of 1909, urged general Indian unity, and was considered by Muslim fundamentalists to be anti-Muslim. He remained faithful to the Congress until 1920, when Gandhi, with his strong religious motivation, won an overwhelming ascendancy over that body. At that time the liberalizing reforms of the 1919 constitution offered greater political opportunities to Indians than before and consequently brought the ever latent communal rivalry of Hindus and Muslims into heightened activity. During the years 1920–1922 Mr. Jinnah and many other prominent Muslims, who had held membership in both the League and the Congress, resigned from the latter body, because they thought

that its policies were jeopardizing the Muslim interests. They feared that the new constitution would deliver India to majority, that is Hindu, rule, and that therefore the Muslim community must organize an effective defense.

In 1934 Mr. Jinnah was elected permanent president of the Muslim League. The still greater political opportunities given Indians by the 1935 constitution, as in the case of the 1919 constitution, further increased the friction between the Hindu and Muslim communities. Under the conditions so created Mr. Jinnah converted his position as president into a dictatorship. His followers have given him the title of Qāīd-i-ʿAzam, which means "great Leader," and regularly use it in addressing him or speaking of him. His domination is indicated by such a resolution as that adopted March 23, 1942, at a Pakistan celebration in Calcutta, which states, "This meeting emphatically declares the Qaid-i-Azam Muhammad Ali Jinnah, President of the All-India Muslim League, alone represents and is entitled to speak on behalf of the Muslim nation." This function Mr. Jinnah exercises without any equivocation; anyone opposing him, as even the premier of Bengal in 1941, is forced out of the League. Mr. Jinnah is a man of quick and biting repartee, egotistic and sensitive to insult. He has the keenest sort of legal mind, and conducts his arguments with intricate and baffling reasoning. He is known for his personal honesty, which he carries into his public life, having shown himself unsusceptible to political bribery. On several occasions he has refused government offers of high office. In his devotion to Pakistan he attacks ferociously and without prejudice anyone—Hindu, British, or Muslim—who opposes the demand. Under him the Indian Muslim community has been acquiring some of that quality of a well-drilled regiment which Islamic religious philosophy inculcated in the seventh-century Arabs.

8. MUSLIM OPPOSITION TO, AND NON-MUSLIM SUPPORT OF, PAKISTAN

During the first three or four years after the Muslim League formally adopted Pakistan as its goal (1940) the vogue of the idea in the Muslim community as a whole was restricted. A number of Muslim parties were relatively indifferent to it; some others were directly opposed. The direct opposition came not only from the anti-communalist Muslim members of the Indian National Congress, who were organized as a sub-party called the Nationalist Muslim Party, but also from other Muslim groups. Among these were the All-India Momin (*Mu'min*) Conference, a rather loosely organized party drawn from the economically depressed Muslim classes; the Majlis-i-Ahrār, a belligerently left-wing and religiously fundamentalist group which originated in the Punjab to relieve the Muslim majority of Kashmir from the discrimination it endured under the rule of the Hindu maharaja; the Āzād party of Sind; the Jamʿīat-al-ʿUlamā', a convocation of Muslim divines; many Shiah, or sectarian, Muslim groups (the Shiahs comprise about 8 per cent of India's Muslim community); the Aḥmadīyas, a small extremist sect motivated by a Messiah theory. Most of these bodies either never were effective in politics or have lost the effectiveness they once had. The Nationalist Muslims, for example, won only 11 seats against the League's total of 426 in the 1946 provincial elections; the Jamiat-al-Ulama won only 5; the Momins 5, the Ahrars 1.

One group which has always been opposed to Pakistan, and today remains the only really strong Muslim organization combating it, is that of the Khudā-i-Khidmatgār ("Servants of God"), the so-called "Red Shirts" of the North-West Frontier Province. This is a group closely affiliated to the Congress; its leader, Abdul Ghaffar Khan, has been deeply influenced by Gandhi's teaching and practice of non-violence and has introduced similar doctrine and methods among his Pathan followers in resisting the Government of India. In the 1946 elections this group won 19 of the 34 seats reserved for Muslims in the North-West Frontier Province; the League won the other 15. The Red Shirts' seats, together with the 9 general seats and 2 of the 3 Sikh seats, give the Congress control of the province. But the division between Red Shirts and League Muslims in the province is so close that local affairs are always unsettled and disturbances may occur at any moment.

For several years after the League adopted Pakistan, the chief support for it came, not from the Muslim provinces which were expected to constitute the Muslim states, but from Muslims in provinces that were not to be included. It was opposed in Assam and the North-West Frontier province and, as we have seen, still is. In the Punjab, Bengal, and Sind the support was lukewarm and the opposition too strong for the League and Mr. Jinnah to overcome until after the Churchill government had confined the Congress leaders and so crippled the party. The premiers of those three provinces were at first all outside the League. Now, of course, the situ-

ation is changed, and the League directly controls the government of those provinces and has practical control in the third (Punjab). It was the United Provinces and others, where the Muslims were numerically inferior to the Hindus, that gave Pakistan its early strength; where the Muslims were a majority they seemed unapprehensive. After the Churchill government in 1942 sent Sir Stafford Cripps to India with constitutional proposals that would have made Pakistan possible, the impression got around among Muslims that the British, who after all had the power, felt that Pakistan was reasonable and should be granted—or, at least, that the Churchill government was supporting the Pakistan proposal. The Cripps offer went a long way toward producing the League's present unmoving stand on Pakistan, which the Labour Government's recent Mission (containing the same Sir Stafford as a member) deplored and refused. It was a rude shock to the League to find that the Labour government was reversing the position of 1942. The White Paper of May, 1946, which pointed the way to self-government for India as an undivided nation, must have seemed to the League quite the "melancholy document" that it did to Mr. Churchill, though not for the same reason, since Mr. Churchill's melancholia arose from the fact that India was offered the right to full independence, rather than Dominion Status, and might therefore slip out of the Empire.

Whenever it has been proposed to Mr. Jinnah that a plebiscite on the Pakistan issue should be held in the provinces which would constitute it, he has refused, seeming to fear that the Muslim community might not be solid enough behind the project to carry it against the non-Muslims. It is, however, clear that today the Muslims as a whole support it; for the League's brilliant success in the 1946 elections was based on a campaign in which Pakistan was almost the only issue.

The League and Mr. Jinnah have often tried to get moral support for Pakistan from Muslim countries outside of India, especially those in the Near East. They have had little answer except silence. They have specifically spoken strongly against the further admission of Jews into Palestine, thus aligning themselves with the Arabs, but again the Near Eastern Muslim states have given no encouraging response. These states have for many decades been fighting a nationalist battle against Britain and France. In India it is the Indian National Congress which they see as conducting a similar struggle; hence they give their support to it, rather than the Muslim League, whose program seems likely, by dividing India, to perpetuate the very imperialism which they are resisting.

Outside the Muslim community the largest body of popular Indian support of Pakistan is found among the Hindu Depressed Classes, also known as Untouchables, Fifths, Exterior Castes, *Harijan* "Lord's Folk" (Gandhi's term), Scheduled Castes (Government of India's official designation). Their number as returned in the 1941 Census is about 50,000,000, close to 12 per cent of the total population. Around 1,800,000 of them can qualify for the franchise under the existing regulations; the number is less than 5 per cent of all the qualified voters. The Depressed Classes are the lowest in the Hindu social scale, and are subject to severe social and economic disabilities, because their touch or often even proximity imposes upon upper caste Hindus ceremonial pollution of food, drink, temple and living premises, religious rite, and person. The social injustices which they suffer are universally deplored; all forward-looking and humane Indians urge amelioration. Conspicuously, Gandhi has led dramatic campaigns in their behalf, supported by the Congress. Outside the Congress there have been other movements, notably some headed by members of their own castes.

In the past the depressed castes have usually been able to better their condition only by accepting conversion to Islam, Sikhism, or Christianity. All three of these religions deny the validity of caste and in theory claim to offer the depressed castes the refuge of a casteless society, but in practice they have not fully succeeded in avoiding caste features. Nevertheless, low-caste converts improve their social and economic position markedly by joining one of these other communities. In recent years further resources have become available to them. The Government of India has sought to give them protection through special legislative representatives, and the present constitution reserves for them 151 seats out of the 1,585 in the provincial assemblies. In 1932, when discussions were taking place which led to the drafting of the 1935 constitution, the British Government, with Mr. Ramsay MacDonald as Prime Minister, decided to give the Depressed Classes separate representation with separate electorates, like those awarded to the Muslims, Sikhs, and some other communities. But Mr. Gandhi felt that the Depressed Classes should not be separated from the General Constituency and

went on a "fast unto death" in protest against the separate electorates. The result was that an agreement was reached between the Congress and representatives of the Depressed Classes, and ratified by the British Government, confirming separate representation but denying the separate electorates. The system now is that the Depressed Classes hold primary elections among their own members to select candidates, up to the number of four for each seat, who are then voted for in the general elections by the General Constituency, which includes the Depressed Classes. The Congress, of course, enters its candidates in the primaries. If a Congress candidate can place among the four who are to contest a seat, he has an excellent chance of winning, since the Congress is the party of the General Constituency.

Not all the politically conscious members of the Depressed Classes have been satisfied with the definite advances they have made through Congress aid. Many feel, whether rightly or wrongly, that Congress is too much a party of upper-caste Hindus to have the interests of the lowest groups at heart. Hence, they have developed their own parties outside the Congress, and these contest the primary elections with the Depressed Classes section of the Congress. And, also, when the Muslim League and the Sikhs have made overtures to these latter parties, they have had a good deal of success. The leaders of the Depressed Classes recognize that their parties have a certain political value, though not yet very great, and they capitalize on it by playing League and Congress against each other. The outstanding leader of the Depressed Classes who are outside the Congress fold is Dr. Ambedkar, and he has given the Muslim League considerable support, though without letting his party become a satellite of the League, and he has written and spoken in favor of Pakistan. From his point of view, Muslims, British, Sikhs, almost anyone would be preferable as rulers of India to the upper-caste Hindus. The many reforms in favor of the Depressed Classes which Congress introduced during the period of its ministries (1937–1939) do not seem to him all that should have been effected.

In the recent elections Congress won 141 of the 151 seats reserved for the Depressed Classes, and of the remaining 10 seats Dr. Ambedkar's party (Scheduled Castes Federation) won only 2. But the Congress Party's victory was only that in the final election by the general constituency. In the primary elections in the case of the 22 seats which Federation and Congress candidates contested, the Federation candidates polled about 84,000 votes against the Congress candidates' 44,000. Dr. Ambedkar's attitude toward Pakistan, therefore, may be assumed to represent an extensive sentiment among the politically conscious section of the Depressed Classes. If, as is proposed, India should institute universal adult suffrage, the political importance of the 50,000,000 Depressed Classes, who comprise about one-eighth of the total population, might become very great. In a united India they could go a long way toward holding a balance of power between upper-caste Hindus and Muslims; if the Pakistan issue were put to a plebiscite, they might determine the result in some localities. But at present they are not politically strong enough to exercise much influence in the controversy.

Further support of the Pakistan proposal comes from the Communist Party of India. This young group claims now to number about 60,000, but it is exceedingly active and well organized, and though it won only 8 seats in the recent provincial elections, its influence in militant peasant and labor movements, for which India offers an almost unparalleled field because of its social and economic backwardness, is high. The party at its first congress (May, 1943) adopted a resolution concerning the solution of India's constitutional problem, which affirms that by its proposed plan, "Every section of the Indian people which has a contiguous territory as its homeland, common historical tradition, common language, culture, psychological make-up and common economic life would be recognized as a distinct nationality with the right to exist as an autonomous state within the free Indian union or federation and will have the right to secede from it if it so desires." The resolution enumerates a number of such potential nationalities: "Pathans, Western Punjabis (dominantly Muslims), Sikhs, Sindhis, Hindustanis, Rajasthanis, Gujeratis, Bengalis, Assamese, Beharis, Oriyas, Andhras, Tamils, Karnatakis, Maharashtrians, Keralas, etc." By these terms, the resolution states, the Muslims, if they should wish, would be able to form a separate state, and it defends this declaration concerning Pakistan by declaring that it "concedes the just essence of the Pakistan demand and has nothing in common with the separatist theory of dividing India into two nations on the basis of religion."

It is evident that this resolution is ambivalent. The long list of nationalities which it enumerates cuts right across the boundaries of the proposed Pakistan, and it would be impossible to recognize them as "autonomous states" and at the same time establish Pakistan. Further, it would take more

than such a resolution to convince most Muslims that the Pakistan demand is not fundamentally religious.

The Communist Party of India has frequently reaffirmed its position respecting Pakistan since adopting the resolution of 1943, and in consequence has been bitterly attacked by the Congress Party. At the end of 1945, because of the Pakistan issue and other matters, there was a complete rupture between the two groups, which had some years before worked together against British rule. When the Muslim League celebrated its "direct action" day on August 16, 1946, the Communist Party joined in the demonstrations. In return a spokesman for the Congress, Mr. Pattabhi Sitaramayya, on September 14 excoriated the Indian Communist Party as trying to promote civil strife and encourage Russian entry into India. His feeling about the danger of Russia, at least, seems to be shared by Mr. Churchill, who in speaking at the Conservative Party's annual conference on October 5 concerning the probable condition of India's people if the country gets its freedom, said, "No one can measure the misery and bloodshed which will overtake these enormous masses of humble, helpless millions, or under what new power their future and destiny will lie." Two such radical opponents as Congress and Mr. Churchill agree very seldom. This time, of course, Mr. Churchill was striking at the Labour Government, which has made freedom for India possible, while Mr. Sitaramayya was expressing his resentment at any group which should give the Muslim League support for Pakistan. But each found in a favorite detestation, that is, in the government of the Soviets, a convenient stick with which to beat his opponent.

9. EFFORTS TOWARD COMPROMISE SOLUTION

Various compromise solutions of the Pakistan issue have been proposed during the past six years. The common element in all of these has been decentralization of government. The industrial and social development of India to make the country a strong, modern nation would seem to require a central government with wide powers, but for the present it is conceded that because of communalism no such government can be established. The most that Indian leaders can hope for is to prevent division of the country into two nations, distrustful of each other if not actually hostile. Some proposals would retain the present general structure of provinces and states united at the center in a common government, exercising some such limited powers as are assigned to it by the Cabinet Mission plan; others would redraw provincial boundaries on linguistic or economic lines; still others have suggested an even looser arrangement, that is, the granting of Pakistan, but with the condition that Pakistan and Hindustan should form a federation for defense and promotion of common economic interests.

One of the most dramatic proposals of the latter sort was made in April, 1942, by Mr. Rajagopalachariar, previously Prime Minister of the Madras Province during the period of the Congress Ministries (1937–1939) and in 1942 a member of the Working Committee (Executive Committee) of the Indian National Congress. At that time there seemed to be a serious threat of invasion by Japan; India was not united behind the war effort; and Mr. Rajagopalachariar proposed that, to gain Muslim cooperation against the common foe, Congress should agree to the creation of Pakistan. Congress, however, refused. Mr. Rajagopalachariar was in consequence forced to resign from the Congress, though without sacrifice of the friendly relations which he enjoyed with the Congress leaders. Two years later, in 1944, he made another proposal of solution, and used it as the basis for meetings and correspondence between Mr. Jinnah and Mr. Gandhi on the subject of Pakistan, but the effort was abortive. Mr. Rajagopalachariar is now back in the Congress, and is one of the Congress members in the present interim government.

A serious effort to determine the fundamental problems of drafting a new constitution for India was made by the Sapru Committee (Conciliation Committee), appointed by the Standing Committee of the Non-Party Conference in November, 1944, shortly after the breakdown of the Gandhi-Jinnah talks on the communal issue. This committee consisted of thirty members, headed by two very distinguished Indian elder statesmen, Sir Tej Bahadur Sapru and Mr. M. R. Jayakar, and in the course of its deliberations had the cooperation of almost all Indian political parties except the Muslim League and the section of the Scheduled Castes headed by Dr. Ambedkar. The committee, of course, found the most pressing of India's internal problems to be that of communalism, and it discussed the problem as a whole, as well as in its specific manifestations, including the Pakistan issue. In seeking a compromise solution of communalism and the proposal of dividing India into two nations, the Committee recommended two great principles in drafting India's new constitution. One was that the powers of the center be very much limited, though not quite so limited as later was prescribed in the Cabinet Mission plan;

the other, that "parity" be adopted in the composition of the central Legislative Assembly. The latter principle meant that the Hindus (excluding the Scheduled Castes) and the Muslims, in spite of the disparity of their numbers, should have equal representation, though the system of separate electorates should be discontinued. This principle, by the Committee's proposals, was also to apply in the Indian Union executive (Cabinet). The idea was not a new one, and had been vigorously opposed by Hindus whenever previously mentioned, on the ground that it would make one Muslim equal to more than two Hindus. The Cabinet Mission in its discussions last spring found the Congress unalterably opposed to parity and rejected it.

When the Cabinet Mission framed its plan, it considered the various mediating solutions that had been offered, and then presented its own form of compromise. Besides prescribing extreme decentralization of government and providing for a kind of Near Pakistan, as we have already seen, the Mission laid down as a principle that, whenever, in the Executive and the Legislature there should arise a question touching a major communal issue, decision should require the assent not merely of the majority of representatives present and voting, but also a majority of the representatives of each of the two major communities. This provision seemed to the Cabinet Mission a sufficient safeguard to prevent the Hindu community from forcing its will upon the Muslims.

Thoughtful Indians do not expect communalism and the Muslim demand for Pakistan to be eliminated quickly or by the simple expedient of a constitutional provision. Liberal pronouncements by government leaders and even liberal legislation will not suffice, nor will exhortations by hopeful and forward-looking Muslim leaders who believe in a united India. These steps are necessary and helpful in arresting the increase of communalism and may even start the process of erasing it. But they will not in themselves destroy the Muslim fear of the Hindu majority and transfer its major interest from religious nationalism to the basic social and economic problems of India. There is needed an effort by the Muslim community itself to acquire wider education and deeper knowledge of the modern world. There is also needed in the Hindu community a more progressive and humanly generous attitude toward the Muslims, such as now exists among some of its leaders but has not yet permeated the middle classes. Cultivation of intercommunity tolerance is, therefore, a joint responsibility of both Hindus and Muslims.

The cure of communalism seems to lie in first curing the great evils of poverty, ill health, lack of education, agricultural and industrial backwardness, an undeveloped labor movement. Once these are under control, religious disagreements are not likely to remain seriously provocative. Yet it is communalism itself more than anything else that right now is distracting India's energy from an attack upon these evils. Mr. Nehru, leader of the interim government, is obviously anxious to put all of India's powers behind such an attack. Hence he has been willing to accept almost any compromise on communalism except surrender to the Pakistan demand. United Hindu-Muslim action to correct India's ills and develop her potentialities is evidently what he hopes to get from the interim Congress and League coalition government. If he can get it on only a few of these basic subjects now, the way will then appear to larger future cooperation in promoting national growth.

But Mr. Nehru has more than just Hindu-Muslim antipathy to deal with. His own party, the Congress, represents a fusion of many elements in India's national life, which diverge on numerous social and economic policies but at present are one on the nationalist issue of freedom from Britain. It is freely prophesied in India that, once the country has gained its independence, these elements will scatter to conflict with one another. For example, Gandhi and the industrialists are likely to clash with the radical Congress socialists led by Jai Prakash Narain. Outside the Congress there are other radical labor and peasant organizations which are seriously dissatisfied with present Congress policies. Mr. Nehru has a difficult task before him in preventing political chaos right now. If India becomes independent, the task will be even more difficult for those with political responsibility, unless the process of modernizing India has been successfully started by the present interim government.

Social and economic planning has been fostered by government and non-government agencies in India for the past five years. The planning is All-Indian in character and embraces all departments of Indian life. Part of some of the planning is already being implemented. To make the present planning succeed, or any other planning which may be developed, India must act as a unit, not divided by religious nationalism into a Pakistan and a Hindustan. In such circumstances, but hardly otherwise, she may realize her hope to take a place in the comity of nations commensurate with her vast population and great resources.

RECENT OBSERVATIONS ON PROGRAMS FOR MEDICINE AND NATIONAL HEALTH IN THE USSR

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(*Read October 19, 1946*)

OPPORTUNITY for observations in twenty medical institutions and for acquaintance with some two hundred professional persons was afforded Dr. Robert L. Leslie, Mrs. Mudd, and myself in the course of a visit to the Soviet Union between the middle of August and the middle of September 1946. Arrangements for the trip were initiated by Dr. Leslie in behalf of the American-Soviet Medical Society and the *American Review of Soviet Medicine*. Our official hosts were Messrs. Vladimir Kemenov, President, and A. Karaganov, Vice-President, of VOKS, the Society for Cultural Relations with Foreign Countries, and their courteous staffs. Medical facilities were made open to us particularly through Dr. V. V. Parin, Secretary-General of the Academy of Medical Sciences of the USSR and Vice-President in charge of the medical section of VOKS, and by Dr. N. N. Priorov, Vice-minister of Public Health of the USSR.

The warmth, the friendliness, the openness of our professional colleagues in discussing matters of common professional interest was most gratifying. We found the Soviet scientists far better acquainted with the technical literature of western Europe and America than our scientists are with Soviet material. The standard journals were seen in Soviet institutional libraries and they were obviously read with understanding. Soviet scientists were eager to have us see, understand, and appreciate their work. We returned with hundreds of pounds of manuscripts, reprints, journals, and books.

The attitude of our Soviet colleagues is conditioned we believe by tragic and personal experience of the suffering, loss, and deprivation caused by the war, by a profound need for peace and security in which to rebuild their country and to provide the necessities and the niceties of life, and finally by a realization that the scientists' world is, indeed, one. And of course Soviet scientists, like any others, have the very human desire to know their colleagues elsewhere and to be known and appreciated by them.

PROGRESS IN THE STUDY OF HIGHER NERVOUS ACTIVITY; RELATIONSHIPS TO MENTAL HEALTH

Of the scientific activities we observed, among the most interesting were evidences of the myriad ramifications of the work of the great Pavlov and his school. Pavlov worked until his death at eighty-six in the physiological laboratory of the Institute of Experimental Medicine at Leningrad. This Institute was founded in 1890 and is the oldest institute of experimental medicine in Russia. Pavlov's laboratory is now in the charge of Professor P. S. Kupalov with a staff of eleven; rooms for the experimental study of conditioned reflexes and operating rooms are in active use. Pictures of Pavlov's association with Professor Walter B. Cannon are prominently displayed. Experimental studies conducted even during the war have been published in the *Transactions of the Physiological Laboratories of Pavlov,* and Professor Kupalov has in preparation a monograph in extension of Pavlov's writings.

Pavlov, feeling the need for more space, built a small laboratory in Koltushi, a suburb of Leningrad. He asked the government for 1,000,000 rubles in support of this laboratory. The government gave him 12,000,000 rubles. Building of the extensive laboratories and of the community now known as Pavlova was begun in 1929. After Pavlov's death in 1936 the institute at Pavlova was put in the charge of Academician L. A. Orbeli. Orbeli decided to undertake the study of the evolution of the nervous system on a large scale, and the institution became the "Institute of Evolutionary Physiology and Pathology of Higher Nervous Activity." The Institute now has a staff of ninety workers with forty-five more in the associated clinic for the study of children. The administrative office is decorated with pictures of Sechenov, Claude Bernard, Johannes Müller, Darwin, Hux-

ley, Sherrington, and the Georgian physiologist, Tarchanishvili.

Studies of the activities of the nervous system at many levels of the phylogenetic scale are in progress at Pavlova. We were privileged, for instance, to meet Professor E. Ganicke, for forty years a collaborator of Pavlov, who has studied the comparative physiology of the conditioned reflex. He has repeated in mice Pavlov's work with dogs. Professor Ganicke said he had been able to demonstrate conditioned reflexes even in insects and in molluscs, though obviously at a primitive level. Work is proceeding under other investigators on a monkey colony, and behavior of children is observed at an associated clinic.

Ontogenetic development receives equal attention at Pavlova. The comparative development of the neuromuscular apparatus and of its behavior is under study in the embryos and the new-born of various animals. Effects of altered environmental conditions such as O_2 and CO_2 tension, blood sugar level, etc. during embryonic development, are also studied.

Development of nervous activity during the maturing of rabbits, mice, rats, guinea pigs, dogs, monkeys, and human beings is under investigation. The cerebral cortex has been found to be relatively undifferentiated functionally in the newborn. The work at Pavlova has demonstrated that in nervous activity, as in morphology, "ontogeny recapitulates phylogeny."

The inheritance of higher nervous functions in genetically known lines of dogs is also under investigation. The "nursery for dogs' children" is well designed and obviously the object of scrupulous care.

Professor M. K. Petrova, for twenty-five years a collaborator of Pavlov, is one of the most creative of his school. She has achieved much of Pavlov's original intent of imitating experimentally in animals characteristic pictures of neuroses and psychoses as they occur in man. Volume 12, 1945, of the *Transactions of the Physiological Laboratories of Pavlov,* with which she presented us, for instance, contains eight articles covering 221 pages by Professor Petrova. Summaries are in English. Experimentally induced phobias in dogs are described. Weakening of inhibitory processes in the central nervous system is shown to be an indispensable condition for the appearance of such a phobia. The nature of the phobia is closely connected with some event previously experienced by the dog and strongly affecting it. The weakening of the inhibitory process could be brought about and the phobia made manifest by prolonged over-strain, prolonged use of conflicting conditioned reflexes, or by chronic alcoholization of the animal. Following amelioration of the conditions cited, phobias disappeared as soon as nervous equilibrium was restored.

No phobia was displayed in various animals throughout the time equilibrium was maintained in their nervous system. Phobia appeared only under the exhaustive factors, weakening the inhibition, which as compared to excitation shows more lability. Phobia disappeared as soon as the nervous equilibrium was restored owing to the increase of inhibitory processes.

Dogs have also been observed over many years in which anxiety states produce trophic disturbances of the skin. Continuous observation of one dog throughout six years "showed that trophic disturbances in the form of extensive exudative eczema appeared every time her nervous activity weakened under prolonged periods of daily work which was beyond her strength." Easing of the work and rest to restore weakened nervous activity resulted in complete restoration of nervous equilibrium together with healing of trophic lesions. Such anxiety neuroses and their accompanying skin dystrophies also responded well to prolonged sleep induced by veronal or by hypnosis. Relapse was induced by the prolonged action of alcohol. Further detailed studies are presented by Petrova on the action on the higher nervous activity and symptomatology of dogs of varying nervous constitutions of prolonged administration of thyroid extract, alcohol, bromine, caffeine, and other drugs affecting the nervous system. Some of this material is in preparation for detailed publication in the *American Review of Soviet Medicine.*

Other outgrowths of the work of the Pavlov institutes we were privileged to see far to the south at Sukhumi in Georgia near the Black Sea. Here an extensive primate colony is maintained as a biological experimental station of the Academy of Medical Sciences of the USSR. The director is a former member of Pavlov's staff, Professor L. G. Voronin. Many aspects of the physiology, psychology, and pathology of these primates are studied in comparison with similar aspects in man. A remarkable feature is the study of behavior under natural conditions, in great enclosures of natural tropical jungle. We were particularly interested in the observations of relationships of mothers and young in *Macacus rhesus* monkeys, and in an "orphanage" of motherless macaques.

These little "orphans" were under the care of a former school teacher, and their remarkable confidence in her was reminiscent of the relationships of trust and kindness between children and teachers with which Mrs. Mudd was deeply impressed in the Soviet nurseries and schools she visited.

To what extent are all these comparative studies of nervous activity contributing to the practical management of mental disease and to the securing of mental health? An American psychiatrist has recently written:

> Modern psychiatry rests to a great extent on the work of three men: a Russian, an American, and an Austrian. The importance of the emotions, and their effect on the biological organism, was brilliantly studied by Walter Cannon. The organization of responses and the conditions of learning were ingeniously investigated and worked out by Pavlov in his studies of the conditioned reflex. The *effects* of conditioning or training, both parental and social, on the development of the human personality were the contributions of Freud.[1]

We were privileged to ask a similar question of a senior Russian psychiatrist, Professor V. A. Gillarowsky, Director of the Institute of Psychiatry in Moscow, during our visit to that institution. Professor Gillarowsky's reply was that the contributions of the Pavlov school were of the greatest importance to practical psychiatry; that the physiological approach to mental disease in his opinion was definitely more valuable than the Freudian. Physiological and chemical work is particularly cultivated in this Institute. Great attention is also paid to psychiatric work with children.

The great importance of psychiatry has become even more manifest in the USSR since the end of the war. Dr. Gillarowsky stated that functional disturbances of the nervous system did not increase in the Red Army during the war. This he attributed to the high morale (the whole-hearted devotion of the troops to the defense of their country), the good attitude of the officers, and the low rate of infectious diseases in the Red Army. The incidence of endogenous psychiatric illnesses has not increased since the war's end. The incidence of functional disturbances of the nervous system did increase in places under German occupation, and has increased in general since the end of the war. When a person is in high spirits, said Dr. Gillarowsky, he can do everything better than when he is depressed and upset, but after a period of prolonged nervous strain comes a period of reaction. Dispensary care at an early stage is particularly important for the care of men in the period of reaction following demobilization.

Particular attention is being paid in the Soviet Union to preventive and early treatment of mental illness. Small hospitals and dispensaries are being built near railroad stations and in centers of population all over the Soviet Union so that patients can be treated early in mental disease; thus many cures are obtained. A capacity of 100 to 150 beds is considered optimal for mental hospitals. Separate hospitals are provided for children and for epileptics. Some patients do not require clinic care but require care in homes; nurses go out to these patients. Particular attention is bestowed on veterans and those who were under bombing. There are at present about 60,000 beds for chronic mental cases in the Soviet Union but 100,000 are desired.

The value in securing mental and emotional health of conditioning to kindness, security, and group solidarity was illustrated in a remarkable way at the Institute for Pediatrics in Leningrad. This is a training school of pediatric medicine, offering a six year course from secondary school to graduation, and a post-graduate course of three to six months, integrated with a children's hospital. There are about 2,000 students, mostly women, and about 1,000 children as patients. Research, care, and teaching all proceed within the same institution, and children long confined to the hospital even have school in the wards. The director, Dr. M. A. Mendeleva, stressed the particular importance of kindness and understanding in working with children. During the terrible period of the siege of Leningrad the hospital was for months under direct bomb and shell-fire. There were many direct hits and the windows of the hospital were shattered three separate times. Five hundred stoves were made and installed in the institute to replace the central heating which was demolished by the bombing. During the summer vitamin needs were met by growing blackberries, raspberries, etc. on the hospital farm and preparing syrups from them. Dr. Mendeleva told us there were no neuroses among the patients during all this time, which she attributed to the confidence of the patients in those who cared for them, the calmness of all of the staff, and the fact that nothing was ever permitted to interrupt the routine.

Consideration of programs safeguarding mental health in the Soviet Union cannot be adequate

[1] Appel, K. E., Nationalism, sovereignty and sanity, Proc. Second Annual Meeting, American-Soviet Medical Society, *Amer. Rev. Soviet Med.* **3** (supp.): 32–39, 1946.

without at least brief reference to the care and training of children in nurseries, kindergartens, and schools. This was a subject particularly of Mrs. Mudd's observations. She was greatly impressed by the conscious and successful effort to make every child feel secure in being wanted and loved and in having a place in the group. The older children also, girls quite as much as boys, had a sense of responsibility to their communities and took it as a matter of course that they should contribute to the needs of their communities by active personal work. The excellent program of child care makes possible active participation in work by women with families.

A saying of Maxim Gorki, widely current in Russia, is that "Children are the flowers of the future." I am told that Russians have traditionally been kind to their children. To what degree the conditioning of children to kindness, group participation, and responsibility is traditional, and to what degree it is a conscious adaptation of psychological principles, we do not know. At all events, it impresses us as basically sound mental hygiene.

COMMUNAL HYGIENE

The Institute of Public and Communal Hygiene in Moscow was founded in 1931 and included in the Academy of Medical Sciences in 1945. It suffered a great deal during the war, repair is still not complete, and equipping is under way. The Institute has eight divisions and eleven laboratories as follows:

1. Division of Air Hygiene and Town Planning in which there are two laboratories: Microclimate and Air Study. 2. Division of Water Hygiene, Water Supply and Canalization in which there are two laboratories: Study of Drinking Water and Study of Sewer Water. 3. Division of Soil Hygiene and Purification of Towns in which there are two laboratories: Soil Study and Helminthological Study. 4. Division of Hygiene of Dwellings and Public Buildings in which there are two laboratories: Lighting Hygiene; Conditioning, Heating and Ventilation. 5. Division of Personal Hygiene and Customs, in which there are two laboratories: Study of Clothing and Articles of Personal Hygiene. 6. Division of Bacteriological Sanitation, with a laboratory. 7. Division of Physiology, with a laboratory. 8. Division of Organization Methods, Consultation and Examination. 9. Division of Municipal Statistics and Legislation.

The staff on the Institute comprises 14 professors with the degree of M.D., 29 senior scientific workers, 22 junior scientific workers and specialists, 6 post-graduate students, 25 scientific auxiliary personnel and 35 business personnel, 129 persons in all. The Director is Dr. A. N. Sysin.

The problems upon which the Institute works as presented to us in writing by Dr. E. A. Bragin, the Assistant Director, are given below, together with some observations noted during our round of the laboratories.

1. Sanitary consequences of the war: (*a*) re-establishment of Stalingrad—expedition into Stalingrad with a staff of 6 scientific workers; (*b*) dwellings in the re-establishment period; and (*c*) cleaning cities in periods of war and subsequent times.

A landscape architect was at work with large maps of Stalingrad, major buildings, parks, etc. Particular attention was being given to discovering the optimal relation of parks and recreation centers to the distribution of the population and to the planting of trees in the city. The design and location of buildings with respect to air currents and ventilation were under consideration. Formulation of optimal hygienic conditions in town planning is being sought. A book is now in press on the planting of trees in cities.

2. Acclimatization: (*a*) population in Arctic conditions—expedition to Dikson Island with staff of 3 persons; (*b*) clothing and conditions in different climatic zones.

Study of the influence of the microclimate of cities on persons is carried out by observation of the condition of meteorological factors in 5 points of the city of Moscow with meteorological statistics. The problem is an explanation of the hygienic problem of creation of the most suitable micro-climatic conditions in different parts of the city, depending on the function of these parts, by means of planning and of planting trees in the city. The laboratory establishes special methods for outer districts for the purpose of massive carrying out of observations.

The study of acclimatization of persons is carried out in different climates of the USSR by special programs, both for local institutes and also a special expedition into the Arctic. The expedition visits Dikson Island, Igarku and a series of points on the shore of the Karsky Sea. The study referring to conditions, morbidity and meteorological factors gives a great amount of material which has been obtained in these places in a series of years.

3. Pollution of atmospheric air: (*a*) dust pollution in relation with meteorological factors and the significance of planting trees in the regions where the air is full of dust; (*b*) bacteriological pollution of the air and its sanitation.

The influence on the process of self-purification of air by filtration through planting trees is seen in dif-

ferent regions of Moscow and it is seen in places significantly covered with dust as well as those little covered with dust in different seasons of the year.

Studies are carried out on the characteristic processes of self-purification and pollution of air by the method of study of the loss of solar radiation and its specific participation depending on change in content of aerosols and micro-elements of the air medium.

A theory of normal pollution of the air is being developed for establishing different origins of pollution, for establishing city standards of planning for the purpose of different types of businesses.

Detailed studies are conducted with regard to fuels, wind velocity, humidity, temperature, etc. in relation to the smokes and fumes from specific installations in Moscow and Stalingrad and of better methods of stoking, precipitation, etc.

We saw apparatus for the collection of dust on oiled slides supported in vertical and horizontal planes on a weather vane device, and a portable device containing batteries, fan, flowmeter, and cotton strainer for collecting and weighing dust.

With regard to ridding the air of confined spaces of its pathogenic micro-organisms, work was proceeding along the lines in progress in the United States but was at a relatively early state of development in the Moscow laboratory. A simple infection chamber was available in which bacterial aerosols were sprayed and the killing action of ultraviolet radiation and of germicidal vapors was under investigation. Vapor of fir balsam was reported to be germicidal and the vapor of certain vinyl ethers was reported as bactericidal in a concentration of 0.1–0.2 mgm per liter of air. "The activity (of this vinyl ether) is not found to be dependent on the humidity of the atmosphere, and therefore this preparation is preferred above triethylene glycol (Robertson)." A 6,000 volt electro-precipitator is reported to be a sensitive detector of bacteria in air.

4. Pollution and self-purification of water; (*a*) reservoirs and sanitary conditions of them—expedition to Klyazminsky reservoir (water station) with a staff of 8 scientific workers; (*b*) manufacture of sewerage water and its significance in pollution of water.

Charts of bacterial counts of the Moscow water supply since 1937 were on the wall. These counts were high when the water supply was chiefly derived from the Moscow River; it had been lower in recent years with water coming mainly from the Volga.

Stress was laid upon a method of bacteriological sampling of water in which the water was filtered through a collodion membrane held in a filter of Seitz type. The membrane was then removed, laid on the surface of an Endo-agar plate and incubated. *E. coli* colonies of characteristic appearance grew out in the membrane. A member of the staff described this and other "Russian methods" and said proudly, although with some embarrassment, that these were the reasons they had not adopted American standard methods of water analysis.

5. Sanitary indications of soil pollution.

In the laboratory of soil hygiene it was explained that during the siege of Stalingrad and in other circumstances of prolonged deprivation of protein during the war, the colon bacillus flora of the feces of the human population was greatly reduced.[2] Many bacteria with typical biochemical reactions of *Aerobacter aerogenes* appeared in the feces under these circumstances.

The work carried out in the Soviet Union and in part by the Institute of Hygiene indicates complete absence from soil not polluted by persons or animals of both *A. aerogenes* and *E. coli;* and that the presence of either is an indication of some sort of pollution. Thermophiles are also used as indicator organisms for animal and human fecal pollution. The thermophilic organisms resulting from human fecal pollution have a lower temperature tolerance—up to 60° C.; those of some animal feces tolerate 60° or above.

Detailed description of the studies of these laboratories regarding sanitation, mineralization of organic matter, and microbic antagonisms in the soil will not be attempted here.

6. New sources of lighting and their sanitary purposes.

The Division of Hygiene of Dwellings and Public Buildings has existed in the Institute from the day of its beginning in 1931. The Division consists of: (*a*) laboratory for the hygiene of special and artificial lighting; (*b*) laboratory for the hygiene of heating, ventilation and air conditioning in which there are special chambers for microclimate with the use of conditioned air. The staff of this Division is 14 persons. The chief of the Division is Professor S. I. Vetoshkin, M.D.

The Division has as its basic problems the working out of hygienic problems for scientific basic planning, outfitting and improvement of dwellings and public buildings:

(*a*) Study of micro-climate of reserved spaces (study of village buildings, air ventilation, large buildings, etc.). At the present time there is experimental study of few-storied buildings in Stalingrad,

[2] Those who have read Simonov's *Days and nights* may appreciate the spirit of people who investigate the intestinal flora under the appalling conditions of Stalingrad.

Moscow and abroad with the Division working on hygienic problems of normal dwellings, inner outfitting and arrangement of dwellings in the post-war period (expedition to Stalingrad and abroad).

(*b*) Study of climatic lighting and the physiological-hygienic basis of the method and norm of natural and artificial lighting of closed dwellings and open spaces. In the pre-war years, the laboratory of hygiene of lighting worked on the questions of: (1) lighting of schools, (2) lighting of medical establishments, (3) lighting of dwellings and (4) climatic light in Moscow. In subsequent years the laboratory is attacking the study of new sources of light (luminescent lamp) in a hygienic relation—physiological-hygienic purpose of luminescent lamp of low pressure mercury arc and also sterilamp (bactericide).

In the current year one doctor completes a dissertation under the direction of the laboratory of hygiene of dwellings on the theme: "Hygienic basis for lighting schools"; besides this, post-graduate students have carried out dissertations in collaboration with the Division on the theme: "Hygienic requirements for lighting medical institutions."

7. History of hygienic thought in the USSR until the Revolution and in Soviet times.

8. Network of scientific study and sanitary-prophylaxis establishments in the USSR.

9. Home and municipal legislation in relation to sanitation and further perspectives.

THE PREVENTION OF SPECIFIC INFECTIOUS DISEASES

The Central Institute of Epidemiology and Microbiology of the Ministry of Public Health has grounds and buildings on the outskirts of Moscow and plans for greatly extending its facilities over a period of five to ten years. Diphtheria and tetanus toxin, toxoid and antitoxin, smallpox vaccine, typhus vaccine, polyvalent dysentery vaccine, polyvalent dysentery bacteriophage, and BCG vaccine for tuberculosis are produced here on a large scale. During the war this Institute was evacuated to the Ural Mountains and produced the needed biologicals there. Production methods are standard, but less well provided with mechanical appurtenances than in this country.

Smallpox and BCG vaccine for shipment to remote parts of the USSR are dried *in vacuo* from the frozen state. "We are most satisfied with the results," Academician Michal Morosow told us. Typhus vaccine is produced by the mouse-lung method under the direction of Dr. Maria Krontovskaya. BCG vaccine is produced by growing the Calmette strain on a synthetic medium containing glycocoll, asparagine, and salts. Polyvalent dysentery vaccine contains Shiga toxoid and the five classic Flexner strains. Polyvalent dysentery bacteriophage preparations were prepared also and scattered during the war in soil, sewage, and food, and given by mouth. The Director, Professor L. Jankelevich, said that statistics regarding bacteriophage were weak; he had observed its therapeutic use, however, and thought the results were good. "The patient has no more dysentery," the day after administration, he said.

Polyvalent bacteriophage as a prophylactic against the diarrheal diseases is also produced in the All Union Institute of Biological Prophylaxis of Infections (Professor Z. V. Ermolieva, Director). This is a highly polyvalent preparation containing phages against *E. coli; Shigella dysenteriae* (Shiga), *S. paradysenteriae* (classic Flexner types), *Salmonella paratyphi* (A and B), *Proteus* and *Ps. pyocyanea.* The polyvalent phage is given children in children's gardens and summer camps every ten days from May to October. Professor Ermolieva cited experiments in which groups of children had received this phage and control groups physiological salt solution, with a lower rate of incidence in the protected than in the control groups. Statistical studies are promised for the *American Review of Soviet Medicine.*

Later we saw polyvalent dysentery bacteriophage prepared both as broth filtrate and in dry tablets in the Institute of Microbiology, Epidemiology and Bacteriophagy of the Ministry of Health of the Georgian Republic in Tbilisi. The Director of Research there, Professor V. S. Antadze, told us that there had been prejudice against bacteriophage also in the USSR but that this had been overcome by controlled experiments with human populations matched for age, weight, etc. The main point, he said, is to use many types of phage active against Shiga, Flexner, Hiss, and Sonne types of dysentery bacilli. Phage is given by mouth. For treatment, administration must begin as early as possible in the disease. In early acute dysentery, Dr. Antadze said, there is almost immediate cure; the patient feels better in two or three days if the phage types coincide with the types of the infecting organisms. Effectiveness is very low in chronic dysentery.

Dr. Antadze told us that they were also obtaining favorable results with polyvalent bacteriophage against *E. typhosa* in typhoid fever. Cases treated in the first days of clinical symptoms were believed to be shortened to fourteen or fifteen days duration. Polyvalent typhoid phage was used both for prevention and treatment. It had not been successful, however, in clearing up typhoid carriers.

BCG vaccine, we were assured in the Institutes in Moscow and also in Tbilisi, where it is prepared for the Georgian Republic, is now given to every new-born child in the USSR. In Georgia for the past two years BCG has been administered by mouth to all new-borns within the first week of life. In view of the difficulties encountered in getting BCG adequately tried in this country, despite the convincing statistics of its value from the Scandinavian countries, among the American Indians,[3] etc., I was a bit skeptical on this point, but have been assured by the highest authorities that it really is given to all children, and moreover to populations under special risk, such as nurses in tuberculosis hospitals.

Another interesting class of anti-infective agents has been developed in the Institute of Biological Prophylaxis of Infections. According to Professor Ermolieva, lysozyme from the horse-radish has been used since 1934 in otolaryngology and ophthalmology. Egg-white lysozyme prepared according to Bordet is used as a spray in laryngitis. According to Ermolieva "all the best singers insist on it." I asked Professor Ermolieva why they did not use the original source of lysozyme, namely tears. She replied, "In my institute there are not so many tears. Once I had tears and I remembered lysozyme and tried to catch the tears in a spoon, but then I had no more tears."

Another anti-infective called "erythrin" is extracted from erythrocytes. This is said to be bactericidal against *C. diphtheriae,* staphylococci, and streptococci. Sprayed into the nose and throat four times per day for four days in one to three courses it is reported to clear up the chronic diphtheria carrier.

Preventive measures against rabies were touched upon by Dr. V. Ushakov of the Institute of Experimental Medicine in Leningrad. Dr. Ushakov began work on hydrophobia in the first Pasteur Institute in Russia, organized in 1886. He joined the staff of the Institute of Experimental Medicine in 1890, where he is still actively working at eighty-one years of age.

REHABILITATION OF THE WAR WOUNDED

The Soviet Union has established some three hundred hospitals over the Soviet Union for veterans of the war. Special schools for injured veterans are maintained by the Department of Public Welfare. There are some seventeen institutes for special surgical rehabilitation of the war wounded and of the victims of industrial and other accidents. The largest of these is the Central Institute of Traumatology in Moscow. Dr. N. N. Priorov, Vice-Minister of Public Health of the USSR, is Director of this Central Institute. Dr. Priorov did us the great honor of showing us through this splendid hospital himself.

During the war, Dr. Priorov told us, special work shops were organized in the hospitals. In these an effort was made to learn the experience and training of each man and to plan his rehabilitation accordingly. Now, special schools for injured veterans are maintained under the Ministry of Social Welfare. Invalids are divided into three groups: (1) people unable to work or to take care of themselves; (2) people unable to work but who can take care of themselves; (3) people who can work, even though their kind of work may need to be changed. The main source of psychological disturbances is in persons who do not know what work to do; when work is found for them as a rule they become normal mentally.

Cases were described and shown to us of veterans who had lost both hands; the bones of the forearm were separated by the Krukenberg operation; the men seemed quite unselfconscious about using these arms for greeting and other purposes. Veterans who had lost both hands had entered law school and a school of economics. Veterans blind or without both legs were seen and others with spinal and facial injuries in various stages of plastic and restorative surgery. Their spirit and the relationships between staff and patients impressed us as strikingly good. The injured veterans included women as well as men.

An interesting accessory to surgery was shown us in the case of hyaluronic acid prepared from bovine vitreous humor, which was injected intragluteally for softening scars and to facilitate healing.

There are special work shops and factories in the Soviet Union for the manufacture of prosthetics. These are being revised with the aid of prosthetic devices purchased in America. Poliomyelitis is treated in acute stages by neurologists; in late stages by orthopedic surgeons; transplantation of muscles is sometimes resorted to. The Kenny method is not used.

THE FIVE YEAR PLAN OF THE ACADEMY OF MEDICAL SCIENCES

A comprehensive five year plan of medical research and its applications was adopted in pre-

[3] Aronson, J. D. and C. E. Palmer, Experience with BCG vaccine in the control of tuberculosis among North American Indians, *Public Health Reports,* **61**: 802–820, 1946.

liminary form by the Academy of Medical Sciences of the USSR early in September 1946, and was formally adopted in November. Three copies of this plan, covering two hundred mimeographed pages, were put into our hands by the officers of the Academy of Medical Sciences; this will appear when translated in the *American Review of Soviet Medicine*. The areas of research covered are thus listed in the table of contents:

I. Main Problems of Public Health in the Post-War Period: 1. Scientific principles of Soviet public health organization. 2. Medico-sanitary consequences of the war and measures for overcoming them. 3. Hygienic standards and sanitation of external environment. 4. Protection of the health of mother and infant. 5. Child health protection. 6. Protection of the health of industrial workers. 7. The problems of nutrition.

II. Medical Problems Arising from War Traumas: 8. Restoration of functions after war traumas. 9. Clinical and pathophysiologic study of traumas of the nervous system and their restorative therapy. 10. Biology of infected wounds. 11. Traumatic shock. 12. The problem of pain.

III. Problems of Infection in Theory and Practice: 13. Infection and immunity. 14. Epidemiology and pathology of infection. 15. Malaria, helminthiasis and other problems of medical parasitology. 16. Ultraviruses and ultravirus diseases. 17. Tuberculosis. 18. Problems of scarlatina in child health protection. 19. The problem of sepsis. 20. Etiotropic therapy of infectious diseases.

IV. Urgent Problems of Clinical Medicine: 21. The problem of malignant growths. 22. Hypertonia. 23. Gastric and intestinal ulcers. 24. Problems of modern hematology and blood transfusion.

V. Physiologic Regulation and Means of Actively Influencing It: 25. Reactivity of the organism. 26. Correlative processes in the organism. 27. Regulation of the composition and properties of the internal medium of the organism. 28. Pharmacological regulation of functions. 29. The influence of physical factors on the human organism. 30. Capacity for work, fatigue and rest.

VI. Physiology and Pathology of Nervous Activity: 31. Factors of integration in the nervous system. 32. The higher nervous activity. 33. Psychoses (pathogenesis and therapy).

VII. Certain Problems of Theoretical Medicine: 34. General physiology and pathology of the cell. 35. Growth and development of the normal and pathological organism. 36. Metabolism and energy. 37. The physiology of digestion. 38. History of medicine.

The Secretary of the Academy tells us that the proposals incorporated in this plan originated with the staffs of the twenty-five component institutes of the Academy of Medical Sciences. They were then subject to discussion between the Praesidium of the Academy and the component institutes. The plan as finally agreed upon was adopted by the Academy and returned to the institutes as a recommended but not obligatory program. The emphasis of the plan on fundamental theoretical problems is noteworthy.

Academician A. I. Abrikosov, First Vice-President of the USSR Academy of Medical Sciences, in comment [4] upon the five-year plan of the Academy, has written in part:

> It is to be pointed out that the five-year plan of the USSR Academy of Medical Sciences insures the genuinely scientific synthesis of the various scattered factual findings obtained by scientists, institutes and laboratories in the course of their work on one or another phenomenon. . . .
>
> The essence of our method does not consist in mere registration of phenomena. The task of the Soviet scientist is to explain phenomena and their causal interdependence, to combine theory with practice in relation to man not only as a biological unit but as a social being whose normal and pathological development is affected first and foremost by the social conditions prevailing in his environment.

Interchange of scientific literature between the United States and the USSR is already established and is growing; the science of both countries is enriched thereby. Good will exists between scientists of the two countries who have had the opportunity for personal acquaintance. It is the author's earnest belief that the good of both countries demands the future broadening of the basis of mutual understanding and good will.

[4] *Moscow News*, November 16, 1946.

PHOTOGRAPHIC METEOR STUDIES. IV. THE GEMINID SHOWER

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ABSTRACT

Five meteors of the Geminid shower were photographed simultaneously by cameras at the two Massachusetts stations of the Harvard Observatory. Rotating shutters on the cameras provide velocity measures leading to a mean observed velocity of 36.0 km/sec for the Geminids or a mean undisturbed geocentric velocity of 34.7 km/sec The corresponding heliocentric velocity is 34.1 km/sec, indicating a heliocentric orbit of period 1.65 years, inclination to the ecliptic of 23°.5, eccentricity of 0.900, and perihelion distance 0.139 a.u. These orbital elements are unique among both cometary and asteroidal orbits. The period is less than half that of the shortest-period comet while the perihelion distance is much smaller than that of any known asteroid.

For the determination of the mean radiant of the shower and the daily motion of this radiant, an additional 36 single trails were studied. The mean apparent radiant is at right ascension 112°.6, declination +32°.8 on the mean date of Dec. 13.3 (1945). The daily motion is 53′ eastward.

Observed radiants have a spread of ±19′ (probable error) from the mean radiant. This random error is apparently cosmic in origin and has not been explained numerically. It probably arises from perturbations by the planets.

1. INTRODUCTION

THE Geminid meteor shower is the best represented shower in the Harvard collection of photographic meteor trails. Some five per cent of all trails can be ascribed to the Geminid radiant. Harvard photographs of forty-three Geminid meteors constitute the observational basis for the present investigation. Four meteors were photographed simultaneously at the Cambridge and Oak Ridge Stations, the camera at the latter station being equipped with a rotating shutter operated by a synchronous motor. Hence the velocity as well as the trajectory has been determined, and the heliocentric orbit has been calculated for each of these meteors. One meteor for which the oribit had been determined and published previously is also included. In addition, two meteors doubly photographed by cameras located at the two stations but not equipped with rotating shutters and thirty-six meteors photographed by one or more cameras at a single station have been used to determine the daily and secular motion of the Geminid radiant.

Meteor photographs from 1899 through 1945 were investigated, although the trails accepted as belonging to the major Geminid radiant cover only the interval from 1903 to 1945. The criteria for acceptance were: (1) The true longitude of the sun at the time of observation must lie within the limits 257° to 263° (1900.0 equinox), i.e., December 10–16 in 1944. (2) The radiant of a triangulated meteor or the great circle of a single-station trail must lie within 5° of $\alpha = 7^h\,30^m$, $\delta = +33°$ (1900.0 equinox). (3) The photographed trail must be measurable and sufficiently long to provide good observational data.

The oribital data for the meteors whose velocities were determined are discussed in the following section, separately from data concerning only the mean radiant and its motion.

2. ORBITS OF GEMINID METEORS

Methods for the reduction of double-station photographed meteors have been described in the first paper of this series (1938). These methods, as modified slightly in the third paper (1940), have been used in the present study.

The fundamental observational data and the orbital elements for the five Geminid meteors as well as their mean elements are given in table 1. The photographic plate numbers refer to the AI camera located at Oak Ridge and the FA camera located in Cambridge. The breaks in the trails photographed by the AI camera are spaced at intervals of 0.05 second. The length of time observed refers to measures of trail breaks. The angle Q is measured between the great circles of the trails, as photographed by the AI and FA cameras, while Z_R is the distance of the radiant from the zenith of the AI camera. Heights are measured from sea level. The angle between the apex of the earth's motion and the corrected radiant is designated as the *elongation*. The deceleration applies at the middle break. The orbital elements are heliocentric, are designated by their customary symbols, and are referred to the ecliptic and equinox of 1900.0.

Because the two photographed trails of Meteor 733 are nearly parallel, as evidenced by the small value of $\sin Q$, and because the radiant and velocity appear somewhat divergent from the other Geminids of table 1, the data for Meteor

TABLE 1

FUNDAMENTAL DATA AND ORBITAL ELEMENTS FOR GEMINID METEORS

Meteor number	727	730	733	736	651†	Mean omitting Meteor No. 733
AI Plate number	33681	33687	33688	33696	33020	
FA Plate number	1637	1641	1643	1645	517	
Sidereal time (Oak Ridge)	$9^h39^m.9$	$8^h29^m.0$	$10^h53^m.1$	$9^h50^m.9$	$8^h08^m.0$	—
	1937 Dec.	1937 Dec.	1937 Dec.	1937 Dec.	1936 Dec.	Dec.
G.C.T.	12.3774	13.3256	13.4254	14.3796	14.3077	13.6
Length of trail (degrees)	8°	12°	14°	5°	7°	—
Number of breaks measured	10	16	16	15	10	—
Length of time observed (sec)	0.50	0.85	0.80	0.75	0.50	—
Relative brightness of trail AI	Faint	Average	Average	Faint	Faint	—
sin Q	0.8515	0.2141	0.0477	0.9910	0.4815	—
cos Z_R	0.8913	0.9679	0.7683	0.8803	0.9777	—
Height at first break (km)	89.75	88.31	104.87	92.72	92.82	—
Height at last break (km)	75.74	59.08	82.96	70.59	74.94	—
Height at middle break (km)	82.72	73.41	93.52	81.50	83.69	—
Height at maximum light (km)	76.49	63.17	87.65	81.22	84	—
Apparent radiant α (1900.0)	112° 12′	112° 41′	112° 49′	113° 16′	113° 15′	112° 51′
δ (1900.0)	+33 00	+32 53	+33 28	+32 47	+32 20	+32 45
Corrected radiant α (1900.0)	110 56	111 46	111 29	112 00	112 26	111 47
δ (1900.0)	+32 29	+32 33	+32 49	+32 15	+32 02	+32 20
Elongation	62 27	62 42	63 6	63 28	63 13	62 58
V_0 Apparent rel. vel. (km/sec)	35.21	35.96	38.26*	36.05	36.56	35.95
V_∞ No atmosphere vel. (km/sec)	35.62	36.62	38.44	36.31	36.81	36.34
V_G Geocentric vel. (km/sec)	34.01	34.97	37.04	34.74	35.14	34.72
V_H Heliocentric vel. (km/sec)	33.46	34.16	35.67	34.39	34.53	34.14
Deceleration (km/sec²)	1.59	2.4	0.98*	1.52	—	—
a (a.u.)	1.302	1.399	1.678	1.434	1.457	1.396‡
q (a.u.)	0.1398	0.1360	0.1270	0.1434	0.1380	0.1393
e	0.893	0.903	0.924	0.900	0.905	0.900
P (years)	1.49	1.66	2.17	1.72	1.76	1.65
Mean anomaly	−24° 57′	−21° 58′	−16° 04′	−21° 17′	−20° 34′	−22° 12′
ω (1900.0)	325 01	324 44	324 25	323 28	324 04	324 19
Ω (1900.0)	259 25	260 22	260 29	261 27	261 37	260 43
i (1900.0)	23 04	24 27	27 26	23 00	23 20	23 28

* Corrected from previously published values (1943). † Published previously (1943). ‡ From mean value of $1/a$.

733 are not included in the mean radiants and elements given in the last column. The calculations were checked carefully in search for a possible error to account for the discrepancy. It is quite possible, however, that the divergences of Meteor 733 represent a true cosmic spread in orbital motion; the uncertainties introduced by the small value of sin Q appear hardly capable of influencing the calculations by the amounts shown in table 1.

The probable error in the determination of a single geocentric velocity is ±1.0 per cent when Meteor 733 is omitted from the mean, in keeping both with the similar value of ±0.9 per cent obtained for the Taurid meteors (1940) and an upper estimate of ±0.6 per cent obtained from a discussion of probable observational errors (1940). The evidence for a cosmic spread in the radiants is demonstrated in a later section of this paper.

The Geminid orbits of table I are shown, projected upon the ecliptic, in figure 1. They are unique when compared with the orbits of known comets, planets, asteroids, or meteors. The

comet of shortest period, Encke's, associated with the Taurid meteors (1940), has a period of 3.3 years, just twice the mean period of the Geminids. Eros and Apollo, most unusual asteroids with the shortest periods, require several weeks longer than the average Geminid for an orbital revolution. The asteroidal meteors (1940) also revolve more slowly. Relatively few comets and no asteroids approach the sun more closely than the Geminids while their aphelion distance is less than that of any other known comet or meteor orbit. The orbital eccentricity of the Geminids is greater than that of any asteroid.

A comet in such an orbit should be expected to disintegrate rapidly because of the frequent perihelion passages at such a small distance from the sun. It is not surprising, therefore, that a meteor shower should be found to represent such an extreme in comet orbits.

The small aphelion distance, on the other hand is puzzling because we are accustomed to associate the aphelion distances of short-period comets with the orbit of Jupiter and possibly to explain the occurrence of such short-period comet orbits as resulting from the perturbing effect of Jupiter. If we presume that the now-disintegrated comet responsible for the Geminid

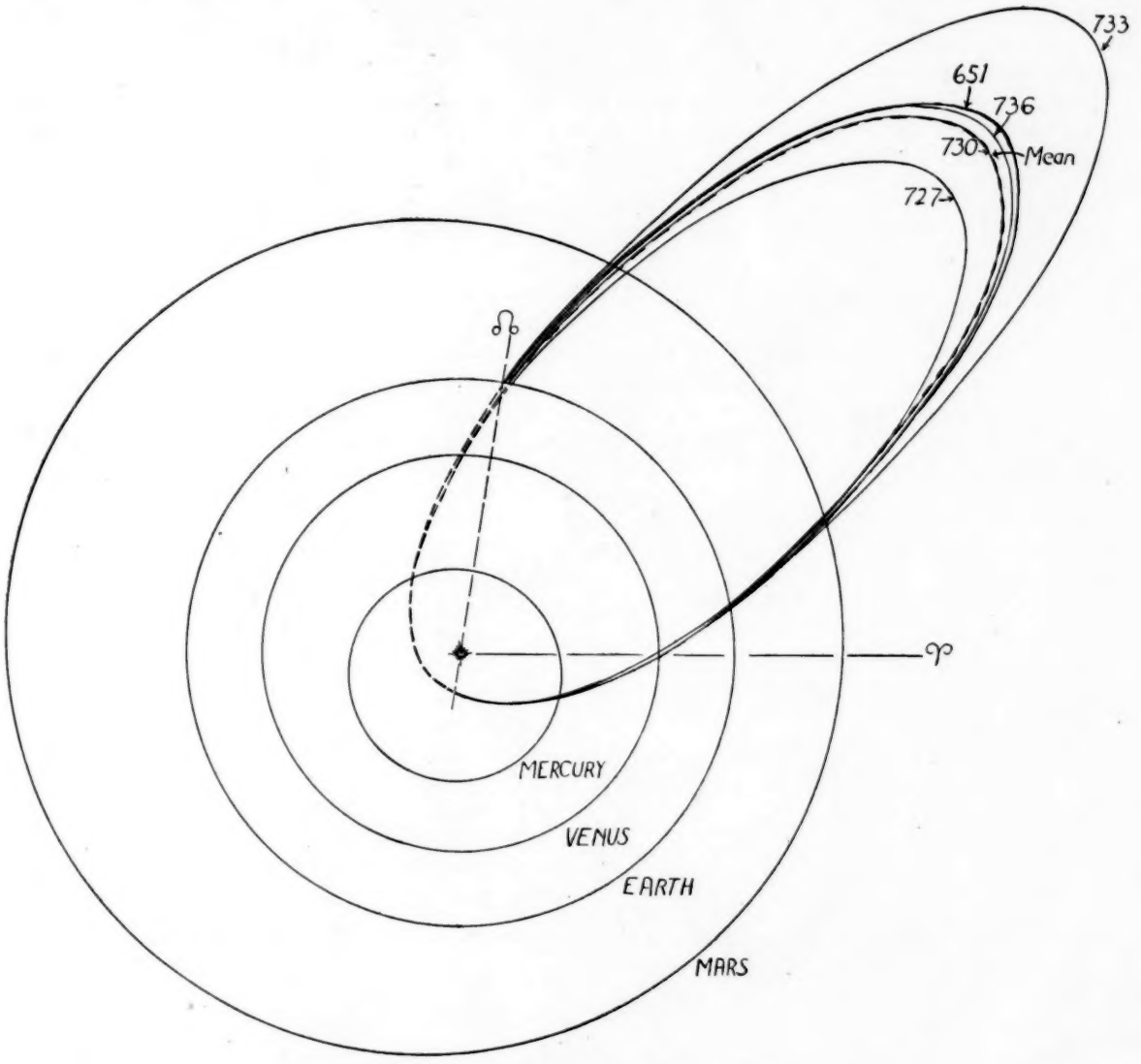

FIG. 1. Projection of Geminid orbits on ecliptic.

meteor swarm was once a member of the Jupiter comet family, we must account for its aphelion distance having been reduced from about 5 a.u. to 2.65 a.u. Although the mysterious process responsible for the apparent shortening of the period of Encke's comet, as deduced by Encke (1866), might be credited with the reduction, a large perturbation caused by one or more near approaches to the earth appears as a more probable explanation. The mean Geminid orbit, in its present orientation, approaches extremely near to the earth's orbit only. In the past, however, the orbit may have been oriented to permit large perturbation by Venus or Mars. The action of Jupiter produces large changes in orientation for such an orbit over a period of a number of thousands of years. An analysis of Jupiter perturbations as was made for the Taurid meteors and Encke's comet (1940) is of little interest for the Geminid meteors because there appears to be no possibility of associating the swarm with any known comet.

3. THE MOTION OF THE GEMINID RADIANT, THEORETICAL

It is desired to determine the daily and secular motion of the meteor radiant from photographic observations of trails made either from a single station or from two stations. In the latter case the radiant point for each meteor is determined and, since the meteoric velocity is known, the radiant can be corrected directly for diurnal motion and zenith attraction. In the former case only the great circle of the meteor trail is known and the correction must be applied in a special fashion.

3a. THE EQUATIONS OF CONDITION

The right ascension, α, and declination, δ, of two or more points a, b along a meteor trail may be obtained by accurate plate reduction or by careful plotting on a Bonn Durchmusterung chart. The direction cosines, λ, μ, ν for each point are given by

$$\left.\begin{aligned} \lambda &= \cos\alpha\cos\delta \\ \mu &= \sin\alpha\cos\delta \\ \nu &= \sin\delta \end{aligned}\right\} \qquad (1)$$

The direction cosines λ_p, μ_p, ν_p of the pole of the great circle through the points a and b are then given by:

$$\left.\begin{aligned} \lambda_p \sin C_{ab} &= \mu_a\nu_b - \nu_a\mu_b \\ \mu_p \sin C_{ab} &= \nu_a\lambda_b - \lambda_a\nu_b \\ \nu_p \sin C_{ab} &= \lambda_a\mu_b - \mu_a\lambda_b \end{aligned}\right\} \qquad (2)$$

where C_{ab} is the great circle distance between the points a and b. The square of sin C_{ab} is obtained from the sum of the squares of the right hand members of equations (2).

In case the meteor is photographed by cameras at two stations A and B, the direction cosines $\lambda_R\mu_R\nu_R$ of the apparent radiant are obtained from the direction cosines λ_{pA}, μ_{pA}, ν_{pA} and λ_{pB}, μ_{pB}, ν_{pB} of the trails as observed at the respective stations A and B, via equations (2), substituting the subscripts R for p, A for a and B for b.

It is necessary to reduce the direction cosines of all radiant or poles of trials to a common equinox. The method presented by E. C. Bower (1932) is recommended. A preliminary mean radiant point α_R and δ_R now may be adopted from the observations, and also a great circle representing the estimated direction of the daily motion of the radiant. The direction cosines λ_{PM}, μ_{PM}, ν_{PM} of the pole of this great circle can be obtained in the manner of equations (2) by passing the circle through α_R and δ_R and a second point chosen from the observations. This second point may conveniently be taken at the same declination as δ_R. A rectangular coordinate system with origin at α_R, δ_A and x-axis coincident with the great circle of motion, x increasing with α and y with δ, is now established.

For a double-station meteor, i, of apparent radiant α_{Ri} and δ_{Ri}, the apparent rectangular coordinates x_i and y_i are given by

$$\left.\begin{aligned} x_i &= (\alpha_{Ri} - \alpha_R)\cos\delta_R \\ y_i &= \delta_{Ri} - \delta_R \end{aligned}\right\} \qquad (3)$$

with sufficient accuracy if δ_R is not too great. In case the great circle of radiant motion does not follow the parallel of declination near the origin of x and y, or in case the declination is too large, $(\alpha_{Ri} - \alpha_R)\cos\delta_R$ and $(\delta_{Ri} - \delta_R)$ can be transformed into x_i and y_i by simple numerical equations, usually linear.

The position of a single trail, j, can be best specified by the intersection point, X_j, of the extended trail with the x-axis, and by the intersection angle, ψ_j (see fig. 2). The right ascension, α_j, of the intersection point is given by

$$\tan\alpha_j = (\nu_{pj}\lambda_{PM} - \lambda_{pj}\nu_{PM})/(\mu_{pj}\nu_{PM} - \nu_{pj}\mu_{PM}) \qquad (4)$$

and the angle ψ_j by

$$\cos\psi_j = \lambda_{pj}\lambda_{PM} + \mu_{pj}\mu_{PM} + \nu_{pj}\nu_{PM}. \qquad (5)$$

The intersection point, X_j, can be determined from α_j as in the preceding paragraph. The

angle ψ_j is taken from 0° to 180° as indicated in figure 2.[1]

The date of the meteor is taken as t_i or t_j, measured in degrees of true longitude of the sun at the time of observation and referred to a fixed equinox. The year of the meteor, Y_i or Y_j, is conveniently measured in centuries from 1900.

The daily and secular motion of the radiant can now be determined for double-station meteors from the observational equations:

$$\left.\begin{aligned} A_x + B_x t_i + C_x Y_i &= x_i \\ A_y + B_y t_i + C_y Y_i &= y_i \end{aligned}\right\} \quad (6)$$

where the coefficients A_x, B_x, C_x, A_y, B_y and C_y are to be found by least squares.

For single-station meteors, the distance D of the calculated radiant x_{cj}, y_{cj} from the great circle of the meteor trail is to be minimized by a least-squares solution (i. e., D_j is to be considered as a final residual). As seen from figure 2, D_j is given by

$$D_j = (x_{cj} - X_j) \sin \psi_j + y_{cj} \cos \psi_j. \quad (7)$$

A substitution of x and y from equations (6) into equation (7) leads to the following equations of condition for a least-squares solution to determine the six constants and to minimize D_j:

$$\begin{aligned} A_x \sin \psi_j + A_y \cos \psi_j + B_x t_j \sin \psi_j \\ + B_y t_j \cos \psi_j + C_x Y_j \sin \psi_j \\ + C_y Y_j \cos \psi_j = X_j \sin \psi_j. \end{aligned} \quad (8)$$

In case the radiants are to be corrected for diurnal motion and zenith correction, the total corrections Δ_{xi} and Δ_{yi} enter the right members of the observational equations (6) in the form $x_i + \Delta x_i$ and $y_i + \Delta y_i$, respectively. The right member of equation (8) is changed to Δ_j where

$$\Delta_j = X_j \sin \psi_j + \Delta x_j \sin \psi_j + \Delta y_j \cos \psi_j. \quad (9)$$

Simple, approximate methods for determining the corrections to the radiants are given in the two following sections. The equations are arranged for the case in which a mean radiant can be adopted for all the meteor trails.

3b. CORRECTION FOR DIURNAL MOTION

The observing station moves westward with a rotational velocity V_s, given by

$$V_s = \frac{2\pi}{86{,}164} \rho \cos \phi' \quad (10)$$

where ρ and ϕ' are, respectively, the radius of the earth and the geocentric latitude of the station; time is measured in seconds of mean solar time.

The corrections to the radiant for diurnal motion are given conveniently by

$$\left.\begin{aligned} \cos \delta \Delta_\alpha &= A_\alpha \sin \theta + B_\alpha \cos \theta \\ \Delta_\delta &= A_\delta \sin \theta + B_\delta \cos \theta \end{aligned}\right\} \quad (11)$$

where θ is the local sidereal time and the coefficients are functions of the apparent velocity, V_∞, of the meteor outside the earth's atmosphere and of the position of the radiant α_R and δ_R. These coefficients are given by

$$\left.\begin{aligned} A_\alpha &= -(V_s/V_\infty) \sin \alpha_R \\ B_\alpha &= -(V_s/V_\infty) \cos \alpha_R \\ A_\delta &= -(V_s/V_\infty) \cos \alpha_R \sin \delta_R \\ B_\delta &= +(V_s/V_\infty) \sin \alpha_R \sin \delta_R \end{aligned}\right\} \quad (12)$$

A mean value of the apparent radiant can usually be adopted for single-station trails, in which case the quantities of equations (12) are constants. Equations of the form of equations (11) can be set up directly in Δx and Δy in case the radiant motion is not along a parallel in declination.

For completeness, the corrected velocity, V_c, is given by

$$V_c = V_\infty + V_s (\lambda_R \sin \theta - \mu_R \cos \theta). \quad (13)$$

3c. THE ZENITH CORRECTION

The zenith distance, Z_R, of the radiant may be obtained conveniently from the navigation tables of the U. S. Hydrographic Office, H.O. 214, by entering the tables with the hour angle ($H.A.$) and declination of the radiant at the astronomical latitude, L, of the station.

The corrected velocity, V_G, and the zenith correction (see Olivier, 1925: 165) are given by

$$V_G^2 = V_c^2 - 2g\rho$$

and

$$\tan \tfrac{1}{2}\Delta Z_R = \frac{V_c - V_G}{V_c + V_G} \frac{\sin Z_R}{1 + \cos Z_R} \quad (14)$$

where g is attraction of gravity (subtracting the term introduction by the rotation of the earth) at the station.

The correction ΔZ_R is always positive and is applied along the position angle v, where, by the sine law applied to the pole-zenith-radiant triangle,

$$\sin v = -\cos L \sin (H.A.)/\sin Z_R. \quad (15)$$

[1] As a numerical check, $X_j \sin \psi_j = \lambda_{pj}\lambda_R + \mu_{pj}\mu_R + \nu_{pj}\nu_R$.

The corrections in α_R and δ_R are then given by

$$\left.\begin{aligned}\Delta\alpha \cos\delta &= \Delta Z_R \sin v\\ \Delta\delta &= \Delta Z_R \cos v\end{aligned}\right\} \qquad (16)$$

The signs of these corrections should be checked in each situation individually.

The corrections for zenith attraction in equations (16) and for diurnal motion in equations

TABLE 2

POSITIONS AND RESIDUALS FOR SINGLE-STATION METEORS

Plate Number	AC 4358	AC 10043	AC 12194	AI 9492	AI 9494	AI 9498	AC 12787	AI 13195
Plate Number	—	AI 7332	—	—	—	—	AI 10383	AC 15825
Year −1900, t	03, −0.40	08, −0.62	10, −4.32	10, −1.27	10, −1.18	10, −1.02	11, −0.40	14, −3.32
December Date, U.T.	13.71‡	12.77‡	9.64‡	12.64‡	12.72‡	12.90‡	13.76‡	10.67‡
Pole of λ	−0.3606	−0.9042	−0.6902	+0.7548	−0.4134	+0.4180	+0.3518	+0.5215
Trail μ	−0.6237	−0.4237	−0.5349	+0.5424	+0.4116	+0.6402	−0.4277	−0.3565
1900.0 ν	+0.6935	+0.0530	+0.4874	−0.3689	−0.8122	−0.6445	+0.8326	+0.7752
Cos ψ	+0.860	+0.143	+0.595	+0.491	−0.955	+0.820	−0.972	−0.910
X sin ψ	−52′	−10′	−280′	−113′	−50′	+18′	+16′	−97′
Residual 0 − C	−37	+38	− 71	− 40	−27	+57	+29	−32
Δx, Δy	−1′, −10′	−26′, −14′	+34′, −13′	+40′, −15′	−5′, −11′	−68′, −42′	−20′, −13′	+26′, −12′
Δ	−61	−37	−261	− 85	−41	−56	+23	−75
Residual 0 − C	− 8	+36	− 32	+ 19	−37	+18	+10	− 9

TABLE 2—*Continued*

Plate Number	AI 13213	AI 13214	AI 14386	AI 22178	RH 3735	RH 5594
Plate Number	—	AC 15844	—	—	AC 29731	—
Year −1900, t	14, −1.27	14, −1.22	15, −1.44	22, −1.33	31, +0.48	33, −3.15
December Date, U.T.	12.68‡	12.73‡	12.74‡	12.66‡	15.27	11.22
Pole of λ	−0.6284	+0.6686	+0.5956	+0.5242	−0.44562	+0.9430
Trail μ	+0.2528	−0.2218	−0.2922	−0.3410	−0.62840	+0.1032
1900.0 ν	−0.7356	+0.7098	+0.7483	+0.7803	+0.63760	+0.3164
Cos ψ	−0.837	−0.804	−0.863	−0.907	+0.804	−0.341
X sin ψ	−18′	−30′	−61′	−49′	−32′	−215′
Residual 0 − C	+26	+17	−16	−15	−47	− 49
Δx, Δy	+16′, −11′	−10′, −11′	−12′, −11′	+28′, −12′	−30′, −15′	−2′, −10′
Δ	0	−26	−57	−26	−62	−214
Residual 0 − C	+35	+12	−23	− 5	−33	− 30

TABLE 2—*Continued*

Plate Number	AC 31632	AI 31311	AI 31313	AI 31314	AI 33672	AC 33981
Plate Number	—	MA 3377	AC 31639	—	RL 1571	—
Year −1900, t	33, −1.33	33, −1.07	33, +0.73	33, +0.85	37, −3.05	37, −2.08
December Date, U.T.	13.00	13.27	15.02	15.15	11.33	12.28
Pole of λ	−0.3018	−0.3128*	−0.3036*	+0.6793	+0.95509	−0.93151
Trail μ	−0.6082	+0.7837*	+0.7730*	−0.1982	+0.23031	−0.36372
1900.0 ν	+0.7342	+0.5366*	+0.5571*	+0.7066	+0.18646	−0.00114
Cos ψ	−0.894	—	—	−0.791	−0.167	+0.062
X sin ψ	−102′	—	—	+15′	−134′	− 99′
Residual 0 − C	− 65	—	—	+ 8	+ 38	+ 27
Δx, Δy	+108′, −62′	−29′, −15′	+95′, −46′	+28′, −12′	−47′, −24′	−30′, −15′
Δ	+ 2	—	—	+41	−176	−130
Residual 0 − C	+ 26	—	—	+14	+ 16	+ 19

TABLE 2—*Continued*

Plate Number	RH 7966	AI 33694	FA 1645	AI 33697	RH 8642	AI 34392
Plate Number	MA 6879	—	—	—	FA 2462	—
Year −1900, t	37, −1.02	37, −0.07	37, +0.03	37, +0.10	38, −1.42	38, −1.30
December Date, U.T.	13.34	14.26	14.36	14.42	13.20	13.32
Pole of Trail 1900.0 λ	−0.88236	+0.59242	+0.16867	−0.28006	+0.8972	−0.7248
Pole of Trail 1900.0 μ	−0.03341	−0.27690	+0.61574	−0.63615	+0.0444	+0.1734
Pole of Trail 1900.0 ν	−0.46940	+0.75655	−0.76968	+0.71894	+0.4394	−0.6668
Cos ψ	−0.498	−0.862	+0.947	+0.899	−0.469	−0.751
$X \sin \psi$	−45′	− 1′	+ 5′	+26′	−89′	−46′
Residual 0 − C	+15	+15	+20	+24	−10	+ 9
Δx, Δy	−39′, −19′	−22′, −13′	−58′, −32′	−72′, −48′	+7′, −10′	−43′, −21′
Δ	−70	− 1	−44	−48	−78	−58
Residual 0 − C	− 4	− 4	− 6	− 9	+ 8	− 8

TABLE 2—*Continued*

Plate Number	AC 34640	RH 8651	AC 34641	AI 34398	IR 2586	AI 35261
Plate Number	—	—	—	—	—	—
Year −1900, t	38, −0.44	38, −0.40	38, −0.35	38, −0.35	38, −0.30	39, −1.57
December Date, U.T.	14.18	14.21	14.25	14.26	14.30	13.31
Pole of Trail 1900.0 λ	+0.2027	+0.8393	−0.9086	−0.8171	+0.9102	+0.8844
Pole of Trail 1900.0 μ	−0.5008	−0.0396	−0.4146	+0.0596	+0.4132	+0.4512
Pole of Trail 1900.0 ν	+0.8415	+0.5422	+0.0497	−0.5734	−0.0289	−0.1197
Cos ψ	−0.998	−0.591	+0.135	−0.625	+0.116	+0.216
$X \sin \psi$	+ 9′	−53′	−32′	−24′	+ 1′	−38′
Residual 0 − C	+16	−20	+ 1	+ 6	+32	+59
Δx, Δy	+18′, −11′	+2′, −10′	−20′, −12′	−24′, −14′	−37′, −18′	−40′, −20′
Δ	+21	−45	−54	−34	−38	−82
Residual 0 − C	− 2	−15	+ 4	− 8	+17	−41

TABLE 2—*Continued*

Plate Number	RH 9377	RH 10786	AC 36897	RH 10788	RH 13627	RL 4277
Plate Number	—	—	—	—	—	MA 9986
Year −1900, t	39, +0.30	41, −2.23	41, −2.22	41, −2.05	45, −1.10	45, −1.12
December Date, U.T.	15.15	12.17	12.18	12.34	13.30	13.28
Pole of Trail 1900.0 λ	+0.6366	−0.2325	−0.8556	−0.8898	−0.3883	−0.9397
Pole of Trail 1900.0 μ	−0.2496	−0.6049	−0.4638	−0.4354	−0.6285	−0.3368
Pole of Trail 1900.0 ν	+0.7297	+0.7616	+0.2299	+0.1369	+0.6739	−0.0600
Cos ψ	−0.831	+0.925	+0.319	+0.221	+0.843	−0.003
$X \sin \psi$	−30′	−82′	−177′	−118′	−34′	−70′
Residual 0 − C	−21	−24	− 49	+ 4	+ 6	+ 5
Δx, Δy	+32′, −14′	+24′, −12′	+19′, −12′	−48′, −24	−37′, −18′	−29′, −15′
Δ	0	−84	−163	−170	−69	−98
Residual 0 − C	−12	− 1	− 8	− 22	+ 5	− 2

* Radiant.

‡ Greenwich Mean Time.

(11) combine to form the correction term Δx, Δy to be applied to the right members of the observational equations (6) or (9) and (8).

4. THE MOTION OF THE GEMINID RADIANT, OBSERVATIONAL DATA

The observational data for the single-station photographs of Geminids are given in table 2.

The meteors are identified by the camera series and numbers. Camera apertures, focal lengths and locations are presented in table 3. The date, t, is measured in degrees of true solar longitude from 261°.40, Equinox 1900.0. The precession was adopted as 50″.24 per year. The direction cosines, λ, μ, ν of the pole of each individual trail are given to four decimals when derived directly from plots on BD charts and to five decimals when derived by accurate plate measurement and reduction from star positions, involving standard coordinates and a least-squares solution. The 1900.0 equinox is used throughout.

TABLE 3

PHOTOGRAPHIC CAMERA SERIES

Designation	Aperture	Focus	Station
AC	1.5 in.	13 in.	O.R.* since 1934.7
AI	1.5 in.	6 in.	O.R.* since 1932.7
FA	1.5 in.	6 in.	Cambridge
IR	8 in.	50 in.	Oak Ridge
MA	12 in.	84 in.	O.R.* since 1938.6
RH	3 in.	21 in.	O.R.* since 1932.7
RL	4 in.	28 in.	Oak Ridge

* In Cambridge previously to Oak Ridge.

The function $\cos\psi$, defined by equation (5) and figure 2, is given directly in table 2. The angle ψ is the angle of intersection between the great circle of the meteor trail and the great circle of assumed radiant motion. The direction cosines of the pole of this motion, λ_{PM}, μ_{PM}, ν_{PM}, are respectively +0.13887, −0.52883 and +0.83729. The assumed motion passed through $\alpha = 110°$, $\delta = +33° 02'$ and through $\alpha = 114°$, $\delta = +32° 48'$, the tilt from a parallel of declination being 3° 58′. The x-axis of the rectangular system suggested by equations (3) lies along this assumed motion with the origin of coordinates at $\alpha_R = 113° 20'$, $\delta_R = +32° 51'$.

The quantity $X \sin\psi$ represents the minimum distance of α_R and δ_R from the great circle of each meteor trail, X being the intersection of the extended meteor trail with the x-axis. $X \sin\psi$ and subsequent entries in table 2 are given in minutes of arc.

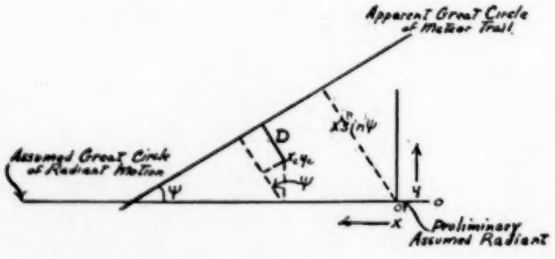

FIG. 2. Geometry of single-trail and radiant.

The quantities Δx and Δy are the corrections to each radiant for diurnal motion of the earth combined with zenith attraction. In those calculations, following the methods of the preceding section, the apparent Geminid radiant for all single-station trails was assumed to lie at $\alpha = 112° 51'$ and $\delta = +32° 45'$, as obtained in table 1. The mean apparent velocity, V_∞, outside the atmosphere was adopted as 36.3 km/sec, and, when corrected for the earth's diurnal motion, as $V_e = 36.5$ km/sec. The corresponding mean radiant was found at $\alpha = 112° 20'$, $\delta = +32° 48'$. The geographical constants for the observing stations have been given in earlier papers (1938 and 1940). The mean calculated geocentric velocity, V_G, came out to be 34.77 km/sec, in accord with the value in table 1.

The quantity Δ of table 2 is defined as a function of $X \sin\psi$, Δx and Δy in equation (9). It represents the minimum distance of the extended meteor trail from the $x - y$ origin after the corrections for the earth's diurnal motion and zenith correction have been applied.

Table 4 presents both the apparent and the corrected radiants, in the form of x and y, for the five double-station meteors of table 1 and two of table 2.

The observational data of tables 2 and 4 provide thirty-six observational equations in the form of equations (8) and seven in the form of equations (6) for both x and y, making fifty observational equations in all for the determination of the six coefficients defining the mean apparent Geminid radiant, its daily motion and its secular motion. The coefficients of these equations are unchanged (practically) when the meteor observations are corrected by Δx and Δy for the earth's diurnal effect and for zenith correction. Hence little extra effort is required to carry through the calculations with the corrected data, by changing the right-hand member of the observational equations to Δ, given in equation (9), or to $x + \Delta x$ and $y + \Delta y$.

5. THE OBSERVED MOTION OF THE GEMINID RADIANT

A least-squares solution of the fifty observational equations for the coefficients C_x and C_y (equations 6 and 8) of the secular motion of the radiant gives numerical values of the same order

TABLE 4

RESIDUALS IN RADIANT POSITIONS FOR DOUBLE-STATION METEORS

Meteor Number	543	538	651	727	730	733	736
AI Number	31311*	31313*	33020	33681	33687	33688	33696
Year	1933	1933	1936	1937	1937	1937	1937
t	−1°.07	+0°.73	+0°.23	−1°.98	−1°.02	−0°.93	+0°.05
x (apparent)	− 78′	− 99′	− 2′	− 58′	−33′	−28′	− 3′
Residual (0 − C)	− 5	−122	+ 2	+ 63	+37	+37	+10
y (apparent)	− 29	+ 54	−31	+ 5	0	+35	− 4
Residual (0 − C)	− 29	+ 41	−40	+ 11	− 1	+34	−12
x (corrected)	−107	− 4	−42	−119	−78	−93	−65
Residual (0 − C)	− 13	− 6	−18	+ 23	+14	− 7	−31
y (corrected)	− 44	+ 8	−52	− 30	−23	− 8	−41
Residual (0 − C)	− 17	+ 36	−24	− 4	+ 4	+19	−13

* See table 2 for data on radiant.

of magnitude as the probable errors of their determination. In addition, the sign of the major coefficient C_x is positive for the apparent meteor trails and negative for the corrected trails. Hence a secular term in the motion of the Geminid radiant is, as yet, indeterminate with a probable error of less than 30′ per century.

The least-squares solutions were then continued after an elimination of the C_x and C_y terms of secular motion to simplify the calculation. The numerical results with probable errors are:

$$\left.\begin{aligned} x &= -16'.1 + 52'.7(\pm 4'.5)t \\ y &= +\ 7'.6 + \ 7'.0(\pm 5'.0)t \end{aligned}\right\} \qquad (17)$$

for the uncorrected meteor trails and

$$\left.\begin{aligned} x &= -36'.7 \pm 53'.3(\pm 2'.4)t \\ y &= -27'.8 - \ 0'.8(\pm 2'.7)t \end{aligned}\right\} \qquad (17\ \text{corr.})$$

for the corrected meteor trails. The mean value of t from the forty-three meteors is −1°.060, corresponding to a true heliocentric longitude +260°.34, 1900.0. With this longitude as a zero point, the calculated motions of the Geminid radiant as given by equations (17) are transferred to equatorial coordinates for the equinoxes of 1900.0 and 1945.0 in table 5. Mean dates for the shower are given for each year, as well as mean predicted radiants and daily motions in both right ascension and declination.

TABLE 5

DAILY MOTION OF GEMINID RADIANT

	Apparent Radiant		Corrected Radiant	
Year and Equinox	1900.0	1945.0	1900.0	1945.0
Mean Longitude Sun	260.34	260.97	260.34	260.97
Mean Date U.T. (Dec.)	12^d.31*	13^d.35	12^d.31*	13^d.35
Mean α	111° 54′	112° 38′	110° 27′	112° 11′
Mean δ	+32° 56′	+32° 50′	+32° 30′	+32° 25′
$\Delta\alpha$ per day	+63′	+63′	+63′	+63′
$\Delta\delta$ per day	+ 3′	+ 3′	− 4′	− 4′
Total motion per day	53′	53′	53′	53′

* Greenwich Mean Time.

The position and motion of the Geminid radiant are not inconsistent with the visual observations made and compiled by Denning (1899) and Olivier (1921, 1929 and 1937) and are in remarkable agreement with those made by Maltzev (1931). A comprehensive study of all the visual observations of Geminid meteors is highly desirable. The fact that the shower appears to contain a large proportion of bright meteors (Millman, 1934 to 1940) encourages one to look for possible systematic differences in radiant and in date of maximum intensity between the visual and photographic observations. Maltzev's results, however, suggest that no observable difference exists. A segregation process among particles of various sizes in the stream is quite possible physically.

6. THE COSMIC SPREAD OF THE RADIANT

The residuals (observed—computed) from the least-squares solutions given in equations (17) for apparent meteor trails and equation (17 corr.) for the corrected trails are presented both in tables 2 and 4. For single-station trails the residuals represent the minimum distance that

the extended great circle of the meteor trail deviates from the calculated radiant. For the apparent trails the probable distance (or error) amounts to $\pm 25'.3$ and for corrected trails to only $\pm 13'.5$. The corrections for the earth's diurnal motion and the zenith correction, therefore, have reduced the observed spread of the radiant by nearly a factor of two. The residuals in x and y separately for double-station meteors have been combined with the residuals in Δ, for single-station meteors, because the theoretical ratio, $2\sqrt{2}/\pi$, is not far from unity.

The probable distance of $\pm 13'.5$ from the mean radiant point for extended single trails corresponds, on the average, to a probable distance $\pi/2$ times greater for the actual radiant point of a meteor. Hence, the random probable error of the radiant point for a Geminid is $\pm 21'$, including measuring error. This value is about equal to that found for the Taurid meteors (1940), but appears to be somewhat larger than is exhibited by Leonid meteors (unpublished manuscript).

It is of vital theoretical importance to ascertain whether this spread in radiants represents a true cosmic spread in the spatial motions of the Geminid meteors before they approach the earth or whether the effect arises from some other cause. Possibilities to be investigated include:

(*a*) Measuring error.

(*b*) Errors in zenith correction because of assumed radiant and uncertain instant of apparition.

(*c*) Deviations of the meteors from linear motion in the atmosphere.

(*d*) Spread in radiant arising from the procedure of combining observations made in different years or nights.

The measuring error can rarely introduce errors greater than $2'$ in the radiant when precise measurement and reduction are employed. Five double-station meteors and seven single-station meteors of the present investigation were so reduced. The probable error of the radiant deduced for these twelve meteors is $\pm 19'$, compared to $\pm 22'$ for the remainder. The difference suggests that the probable error in radiant determinations by the B.D. chart method is of the order of $\pm 11'$, $(\sqrt{22^2 - 19^2})$, corresponding to a probable error of $\pm 7'$ in the distance of a single trail from the radiant. Since the distance from the trail to the radiant is of the order of five times the length of the trail, the measuring error in the trail would correspond to $\pm 1'.4$ at one end, or $\pm 0'.7$ in the middle. The measurements provide a check on this error. Five points were measured on each plot of a trail on a B.D. chart. Two measures near each end of the trail were used in the determination of the great-circle motion while a measure in the middle was used solely for control. The probable error of the middle point compared with the adopted great circle is $\pm 0'.5$, in excellent agreement with the value derived above.

We may conclude that the measuring error contributes only a minor portion of the observed spread in the radiants, the intrinsic spread amounting to about $\pm 19'$ in the probable distance of a measured radiant from the mean radiant.

The error in the assumed apparent radiant used in the determination of the zenith correction for single trails rarely exceeds a degree. An error of a degree would produce a maximum error of about $3'$ in the zenith correction, much less than the error under discussion. The error in the instant of apparition should introduce a probable error less than $\pm 8'$ in the zenith correction. Other computational and methodical errors are much smaller than those discussed above.

The deviations of a meteor from linear motion in the atmosphere are generally small. In an unpublished study of unusual split and crooked photographic meteor trails, the greatest deviations from linearity were of the order of $20'$ along the trail and these were very rare. Such large deviations are conspicuous to the eye when one sights along the trail. This type of observation can be made best from the glass side of the plate with the aid of a low-power hand magnifying glass. A deviation of $20'$ perpendicular to the trail corresponds to sixty microns per centimeter, far above the average observed error of only a few microns. An error of $20'$ in the radiant corresponds to a still much larger error in direction along the trail. Were the atmosphere capable of introducing such large deviations from linearity, the deviations would be obvious from the measures. Detailed observations of the actual deviations will be discussed further in a later paper.

If random errors in the radiant are introduced by combining observations made in different years or nights, then the meteors observed in one night or in one year should show a smaller deviation from their proper mean radiant.

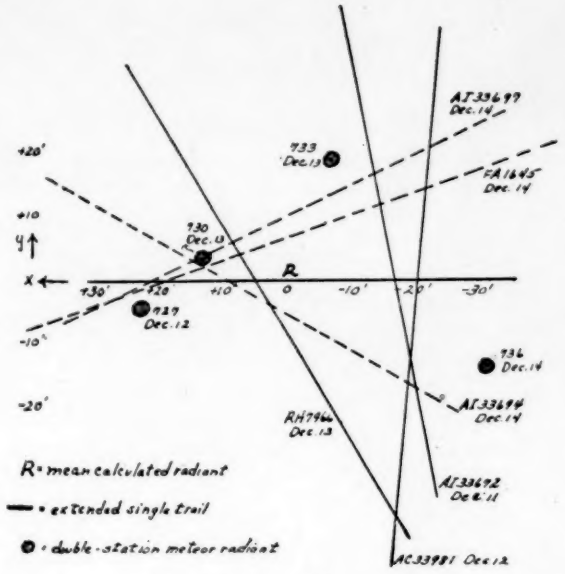

FIG. 3. Geminids of 1937.

Figure 3 shows the extended corrected trails of single-station Geminids and the radiants of double-station Geminids photographed in 1937; figure 4 shows the single-station trails of December 14, 1938. Although radiant points could be chosen to reduce the deviations appreciably from $\pm 19'$, the reduction is not greater than one might expect from the sampling error arising from such a small number of observations. Note that these Geminid trails of 1937 and 1938 were measured and reduced precisely and that the instant of apparition is determined for the two-station meteors.

We must conclude, from inspection of figures 3 and 4, that the Geminid meteors of a single year show random deviations in radiant comparable to those of Geminids observed in different years and that even those observed during a single night show deviations of this same order of magnitude, although possibly smaller, approximately with $\pm 10'$ or greater probable error in the radiant.

We must conclude, furthermore, that these deviations do not arise from errors of measurement, calculation, or from deviations caused by encounter with the earth's atmosphere, but represent random variations of motion among the individual members of the Geminid meteor stream itself.

The observed cosmic spread in the Geminid radiants presents a problem of general interest bearing on the physics and dynamics of the solar system. We may assume confidently that the members of the shower were once incorporated in the main body of a comet and that, sometime in the past, they became separated from the comet. We need not specify the nature of the separation from or the possible disruption of the cometary body except to assume that the relative velocities of the finite particles were small. There is no evidence that particles with a diameter of the order of a centimeter are ejected at high speeds from a comet; no likely physical process except collision with a relatively large body appears capable of producing velocities of the order of 0.5 km/sec.

The particles would have left the cometary body with some distribution of orbital elements about the mean. Variations in the semi-major axis and therefore period, however small, would eventually spread the particles out along and near the mean orbit. The observed finite distribution of orbital elements for particles passing the same point in space must now be explained.

The author favors the explanation that the perturbations by the planets, with Jupiter as the main contributor, introduce random effects because of the differing positions (and later the differing orbital paths) of the individual particles. On this assumption a proper theory should provide some measure of the age of the Geminid

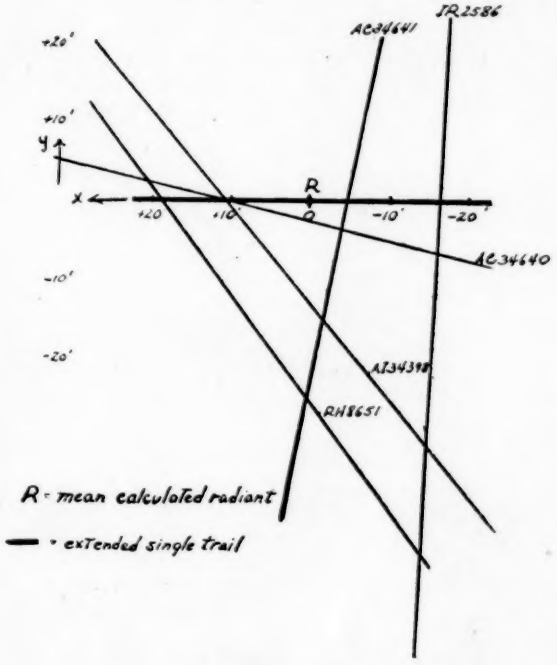

FIG. 4. Geminids of December 14, 1938.

meteor stream. Light pressure effects, such as the Poynting-Robertson effect (1937), and related electrical or electromagnetic effects are wholly inadequate numerically to produce finite deviations over intervals less than several hundreds of thousands of years for meteors of diameter approximately a centimeter. Similarly the force of the Sun's magnetic field on charged particles of the stream is too small to require consideration in the present problem. Direct electrical forces on charged particles could produce substantial effects, but it is not clear how such forces could act under the actual conditions in space. Some type of moving or irregular resisting medium might be postulated, but, without independent supporting evidence, such an hypothesis is practically *ad hoc* and should be considered as a last resort only in case all other rational explanations fail.

No conspicuous correlation between the amount of the deviation in the radiant and the celestial latitude or longitude was found from the observed radiant. A detailed calculation of the expected perturbations in the orbital elements would be required to show whether one might expect an excess perturbation in longitude as compared to latitude. It is hoped that a thorough study of the perturbations of the major planets upon an orbit such as that of the Geminids will be made in the near future. The predictions from such a theoretical study can then be compared with the observational data of this paper with regard to the general direction in which deviations in radiant might occur.

It is a pleasure to acknowledge the assistance provided by a grant from the J. Lawrence Smith Fund. Much of the computational work of this study, carried out by Mr. M. Hurahata, was made possible because of the grant.

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THE PEIRCE–LANGLEY CORRESPONDENCE AND PEIRCE'S MANUSCRIPT ON HUME AND THE LAWS OF NATURE *

(At the Smithsonian Institution)

PHILIP P. WIENER

Managing Editor, *Journal of the History of Ideas*

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1. PEIRCE, AN AMERICAN LEIBNIZ

Charles Sanders Peirce (1839–1914) [1] was trained early by his father, the distinguished Harvard mathematician, Benjamin Peirce (1809–1880),[2] in mathematics, physics, astronomy, logic, and philosophy, and soon showed unusual proficiency often amounting to genius in these sub-

* I am deeply indebted to the Secretary of the Smithsonian Institution, A. Wetmore, and his Assistant, H. W. Dorsey, for their kind assistance in making their files available to me in my researches on Peirce, and for permission to publish the material found there. This is part of a study made possible by a research grant of the American Philosophical Society.

[1] *Cf. Dictionary of American Biography* XIV: 398–403, 1934, art. *Peirce, Charles Sanders,* by Paul Weiss; a paper by the Rev. F. H. Young, "Charles Sanders Peirce, America's Greatest Logician and Most Original Philosopher" delivered Oct. 15, 1945 at Milford, Pa. (where Peirce spent the last 27 years of his life) before the Pike County Historical Society; Ralph B. Perry, *The Thought and Character of William James,* 2 vols. (Boston, Little, Brown, 1935), Chapters 32, 75, 76 are devoted to Peirce, but all index references to Peirce should be consulted; *The Cambridge History of American Literature* III, chapter on "Early American Philosophy," by Morris R. Cohen; H. W. Schneider's *A History of American Philosophy* (Columbia Univ. Press, 1946) includes the latest account of scholarship on Peirce. My two articles in *Journal of the History of Ideas* on "Peirce's Metaphysical Club and the Genesis of Pragmatism" (April, 1946), pp. 218–233 and "The Evolutionism and Pragmaticism of Peirce" (June, 1946), pp. 321–350 deal with the evolution of Peirce's thought. *Cf.* J. Royce and F. Kernan, "Peirce as a Philosopher," *Journal of Philosophy* 13: 701 ff., 1916. The future biographer of Peirce will find it invaluable to consult the Index item "Autobiographical" in each of the six volumes of *The Collected Papers of Charles S. Peirce* (ed. by Charles Hartshorne and Paul Weiss, Harvard University Press, 1931–1935). Most of Peirce's reviews, correspondence and many of his lecture-notes remain unpublished. J. Buchler's *Charles Peirce's Empiricism* (New York, Harcourt, 1939) and J. Feibleman's *An Introduction to Peirce's Philosophy Interpreted as a System* (New York, Harper, 1946) offer the two conflicting aspects, respectively, the scientific and the metaphysical, of Peirce's thought.

[2] *Cf. Benjamin Peirce. A Memorial Collection,* ed. by Moses King, Cambridge, Mass., 1881; R. C. Archibald, *Benjamin Peirce, 1809–1880* (1925); *DAB* XIV, 393–396. While a student of Nathaniel Bowditch, he read the proofs of the latter's translation of Laplace's *Mécanique Céleste.* He wrote, while Professor of Mathematics and Natural Philosophy at Harvard: *Plane and Spherical Trigonometry* (1835–1836) published in a more complete form with a *Spherical Astronomy* in 1840; *Treatise on Sound* (1836) with an introductory bibliography; *Treatise on Algebra* (1837); *Analytical Geometry and Differential Calculus,* Vol. I, Curves, Functions and Forces (1841), Vol. II, Calculus of Imaginaries, Residual Calculus, and Integral Calculus (1846); *Analytical Mechanics* (1855); *Linear Associative Algebra* (1870–1871). Together with his son, Charles, he worked on non-associative algebras. His last work was on "Cosmical Physics": *Lectures on Ideality in the Physical Sciences* (1881). He was one of the founders of the National Academy of Sciences, an early President of the American Association for the Advancement of Science (*cf.* his address of May 18, 1878 on "The National Importance of Social Sciences in the U. S."), an active member of the American Academy of Arts and Sciences, Superintendent of the U. S. Coast Survey (1867–1874), Consulting Astronomer of the "American Ephemeris and Nautical Almanac" from its inception in 1849 to 1867, Associate Editor of the first volume of the *American Journal of Mathematics* (1878), founded by J. J. Sylvester at the Johns Hopkins University.

jects, including also chemistry, the theory of language, and the history of philosophy and science. His intellectual performances resemble those of Leibniz in their wide range, their emphasis on the universality of the symbolism and categories of mathematical reasoning, their attempts to develop a calculus of the fundamental concepts of relations and of probability, their frequent use of Aristotelian and scholastic metaphysical distinctions, and a metaphysical evolutionism (influenced by Darwinism in Peirce's case only, of course) that terminates in theism. Both Leibniz and Peirce outlined many grandiose encyclopedic projects that would unify the exact sciences and the humanities (history, biography, anthropology, philology; theology) on a metaphysical basis, but neither of them ever completed or published a systematic treatise that would consistently realize their high aims. Perhaps, they failed to do so because of the intrinsic difficulties of reconciling the pluralistic and rigorous character of the special scientific disciplines with the merely ideal unity and vagueness of traditional metaphysics.

The only book of Peirce's that was published in his lifetime was one (*Photometric Researches,* 1878) on the measurement of the intensity of light from the stars, but in addition to his scientific work on the value of "g" and on geodesy while he was employed by the U. S. Coast Survey (1859–1891 [2g]), his scholarly productivity was prodigious, especially in logic, methodology, and the history of thought. The six volumes thus far published of his lectures and articles in mathematical and philosophical journals probably contain less than half of the total of his writings. One of his first published papers was a lecture in 1866 criticizing the Aristotelian Syllogism,[3] but his most original contributions to formal logic lie in his extension of De Morgan's and Boole's mathematical logic to the calculus of statements, classes and relations.[4] His important paper on the logic of probable inference, "A Theory of Probable Inference," was included in a volume which he edited of logical researches by his students at The Johns Hopkins University,[5] where Peirce for five years (1879–

[2g] Papers by Charles S. Peirce published as appendices to the Annual Report of the U. S. Coast and Geodetic Survey:

On the theory of errors of observation, Report 1870, app. 21.

Description of an apparatus for recording the mean of the time of a set of observations, Report 1875, app. 15.

Theory of the economy of research, Report 1876, app. 14.

Measurements of gravity at initial stations in America and Europe, Report 1876, app. 17.

A quincuncial projection of the sphere, Report 1877, app. 15.

On the flexure of pendulum supports, Report 1881, app. 14.

On the deduction of the ellipticity of the earth, from pendulum experiments, Report 1881, app. 15.

On a method of observing the coincidence of vibration of two pendulums, Report 1881, app. 16.

On the value of gravity at Paris, Report 1881, app. 17.

Determinations of gravity at Allegheny, Ebensburg and York, Pa., Report 1883, app. 19.

Effect of the flexure of a pendulum upon its period of oscillation, Report 1884, app. 16.

Note on a device for abbreviating time reductions, Report 1885, app. 15.

On the influence of a noddy on the period of a pendulum, Report 1885, app. 16.

On the effect of unequal temperature upon a reversible pendulum, Report 1885, app. 17.

I am indebted to the Acting Director of the U. S. Coast and Geodetic Survey, J. H. Hamlen, for this list as well as for the following exact statement of Peirce's official connection with that bureau:

"He was appointed an Aid in the Coast and Geodetic Survey on September 21, 1859, and served in that grade until June 1, 1860, and again from July 1, 1861 to August 1, 1864. He served as Computer from August 1, 1864 to July 1, 1867. On July 1, 1867, Mr. Peirce was appointed as Assistant, and he served in that position until his resignation from this Bureau on December 31, 1891. Mr. Peirce's principal work in the Survey was the development of methods and apparatus for determining the force of gravity and he made determinations of gravity at a number of stations in the United States and Europe."

[3] Appendix to vol. II (Elements of Logic) of *The Collected Papers of Charles S. Peirce, op. cit.,* II, §792–807: 508–517.

[4] *Cf.* Peirce's paper, Upon the logic of mathematics, *Proc. Amer. Acad. Arts and Sciences* **7**: 402–412, 1867, in vol. III of the *Collected Papers, op. cit.* Peirce anticipated Dedekind's method of the "cut." Peirce "wrote all the definitions on logic, metaphysics, mathematics, mechanics, astronomy, astrology, weights, measures, and universities for the *Century Dictionary* (6 v. 1889–1891)" [*DAB* XIV: 402], and advocated the wavelength of light as a standard unit. He wrote most of the articles on logic for J. M. Baldwin's *Dictionary of Philosophy and Psychology* (1901–1905), proposed to write a new Thesaurus to supplant Roget's, and wrote many anonymous reviews of scientific, psychological and philosophic books for the *Nation.*

[5] *Studies in Logic. By Members of the Johns Hopkins University,* ed. by C. S. Peirce, Little, Brown and Co., 1883. Ten years later, Peirce intended to publish his "Theory of Probable Inference" as Essay XIV of a book *Search for a Method. Cf.* Thomas A. Goudge, Peirce's treatment of induction, *Philosophy of Science* **7**: 56–68, 1940; Professor Goudge is at work on a volume, interrupted by his war service, to interpret Peirce's philosophy of science along lines with which I am in accord, to judge simply from our correspondence.

1884) offered the most original courses in logic and scientific method any American university could then boast of.[6] Peirce had also written a series of articles in the *Popular Science Monthly* (1877–1879), entitled "Illustrations of the Logic of Science," which may be regarded as a turning point in the history of American philosophy insofar as it attempted to bring into philosophy the operational method of science. The first two of these papers were regarded by Peirce as the first formulation of "pragmatism." He had already attacked anti-scientific intuitionism and subjective idealism in a series of four articles in the *Journal of Speculative Philosophy* (1868–1869), in a remarkable review of Fraser's edition of Berkeley (*North American Review,* 1871), and in his Lowell lectures on the history of science (1892). The "lessons from the history of science and philosophy" which Peirce drew in his lectures and projected volumes for a scientific philosophy have never been completely published, but with the recent revival of interest in such studies and in the formation of a Charles S. Peirce Society, there may be extra efforts to do so. The Darwinian idea, "uppermost in men's minds about 1870," led Peirce to an evolutionary conception of logic and the laws of nature which has profoundly affected American philosophers (James, Dewey, *et alia*).[7]

By 1901 Peirce's lack of a steady position and income left him poverty-stricken and dependent on reviewing and hack-work like translating scientific papers for the Smithsonian Institution, whose Secretary, then Samuel P. Langley, took a generous interest in helping to support Peirce. The first letter (April 1, 1901) of the correspondence printed below between Peirce and Langley contains a plea by Peirce to use the Appendices of the Annual Report of the Secretary as a medium for the publication of his life-long and original researches in logic and the nature of reasoning. Peirce refers to a paper by Poincaré (which he had translated for Langley) on the use of hypotheses in science, and condemned Poincaré's conventionalism as an example of a dangerous advocacy of "loose and desultory thought" in line with the equally bad nominalism of Karl Pearson's *Grammar of Science.* Peirce had just reviewed this book severely for Cattell[8] who had written him that it "was so much used by students that something ought to be done to counteract some of its tendencies." Peirce enclosed a copy of his review, along with a newspaper article on "The Century's Great Men of Science"[9] and a review in the *Nation* (vol. 72, no. 1865) of Rev. John M. Bacon's *By Land and Sea,* consisting of scientific observations made from a balloon. In the latter Peirce indicates the "natural way in which science advances. . . . A man first acquires some peculiar facilities for making a certain class of observations, and then he applies these facilities as best he can." In "The Century's Great Men of Science" Peirce elaborated his favorite theme of the historical continuity and objective reality of general ideas, namely, that great scientific discoveries have mostly been made independently by two or more persons. This is illustrated by the leading scientific discoveries of the nineteenth century: "Darwin and Wallace simultaneously put forth the hypothesis of natural selection. Clausius, Rankine, and Sadi-Carnot, perhaps, Kelvin . . . the mechanical theory of heat. Kroenig, Clausius, Joule, Herapath, Waterston, and Daniel Bernouilli . . . the kinetic theory of gases, etc." Ironically enough, Langley and the Wright brothers were soon to illustrate Peirce's point by engaging in the controversy over the priority of inventing the airplane.

In Secretary Langley's reply (April 3, 1901), we note that he recalls "with pleasure" his reading "The Fixation of Belief" (1877), the first of Peirce's six papers ("Illustrations of the Logic of Science").[10] Langley, in the postscript to this letter, invited Peirce to write on the change in the idea of "laws of nature" since Hume's time. Langley thought that Hume's skepticism about reason in religion, as expressed in his essay on Miracles, had been the beginning of the break with the eighteenth-century rationalistic and deistic belief in the certainty of the laws of nature. But, as

[6] *Cf.* "Why Study Logic?" notes of Peirce's opening lecture reported in The Johns Hopkins *University Circulars,* I–II (1879–1880); also, *Collected Papers, op. cit.,* II, ch. 3.

[7] *Cf.* Philip P. Wiener, The evolutionism and pragmaticism of Peirce, *loc cit.*

[8] *Popular Science Monthly* **35**, Jan. 1901.

[9] *New York Evening Post,* Jan. 12, 1901, Sec. IV, Review of the Nineteenth Century. In this section, alongside of Peirce's article, there are articles of considerable interest to historians of nineteenth century scientific thought, by Leslie Stephen on science and religion, by Simon Newcomb on astronomy, and by Oliver Lodge on physics.

[10] *Popular Science Monthly* **12**: 1–15, Nov., 1877, contains this first paper, which together with the second, "How To Make Our Ideas Clear" in the same volume (**12**: 286–302, Jan., 1898), constituted Peirce's "Plea for Pragmatism [1903]."

the correspondence and manuscripts submitted by Peirce emphatically indicate, Peirce was adamant in his belief that Hume's psychological nominalism was inadequate to support the modern notion of scientific laws as probabilities. It is doubtful whether the good Secretary, who was an eminent physicist and not a historian or metaphysician, understood the subtleties of Peirce's scholastic and tychistic realism. Lester F. Ward, who was asked by Langley for an opinion of Peirce's manuscript, replied (April 17, 1901) that he was puzzled by Peirce's statement, based on his tychistic evolutionism, that scientific ideas are becoming "more theological" because "there is less confidence than formerly that laws of nature are unchangeable."

It took Peirce less than a week (April 3–9) to write his first manuscript on "Hume and the Laws of Nature." [11] Langley was not too satisfied and asked in his letter of April 19 that Peirce add "a few words . . . concerning the change of the common view about the meaning of the laws of Nature between Hume's time and our own," to which Peirce immediately replied (April 20) that he would have to write a new article going into the history of the phrase "laws of nature" and into the logic of Hume's argument based on the "balancing of probabilities." This would include a statement of Peirce's own "pragmatical" logic of hypotheses, which he "had been in possession of for five or six years"; perhaps, Peirce is referring to his "Grand Logic" of 1893 in which Abduction, Deduction, and Induction were worked out as the principal types of scientific inference. In any case Peirce's second manuscript entitled "The Proper Treatment of Hypotheses" was received at the Smithsonian Institution on May 13 and returned on May 18 as "too hard reading." [12]

Peirce then began to insist in stronger language that Langley was mistaken in thinking there was any logical connection between Hume's argument against miracles and the older metaphysical notion of the laws of nature, and sent on June 1, 1901 a third manuscript, "Hume on Miracles and Laws of Nature." I have incorporated this autoscript in the "final draft" printed below which includes Peirce's final changes on the draft of Langley's edited version. The excisions and revisions of Peirce's autoscript were proposed by Langley in order to get *The Century Review* to pay $100 for the article, and thus help Peirce financially. But Peirce refused to accept all the changes (for the reasons given in his letter of Sept. 5, 1901), and added further historical and logical comments on Hume's theory of induction and probability that are inserted in the text below with footnotes to indicate where his original autoscript draft differs from this final version.

When the Smithsonian Report for 1901 finally appeared, there was a paper on "The Laws of Nature" but it was not by C. S. Peirce. It was by S. P. Langley who still maintained, despite all of Peirce's arguments to the contrary, that the laws of nature are "laws of our own minds—and a simple product of our human nature"; the good Secretary in offering to help Peirce was apparently unable philosophically to be helped by the metaphysical realism of Peirce.

These documents, then, not only throw additional light on Peirce's personal and intellectual biography, but also on the history and philosophy of science at the opening of the twentieth century when scientists were wondering how aeronautics, x-rays, radio-activity, De Vries' biological mutations,[13] and new developments in mathematics and the logic of probability, were going to change our conception of "laws of nature." In fact, Ludwig Boltzmann, at the International Congress of scientists and scholars in 1904 (St. Louis Exposition), sketched the new statistical conception of laws of nature as superseding Maxwell's preference for the "dynamic" type of causal explanation in classical mechanics. Peirce's premonition of this statistical idea of laws of nature was obscured by his metaphysical attempts to link the new idea with older, scholastic ideas of the teleological order of nature.

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[11] *Cf. Collected Papers of Charles Sanders Peirce*, ed. C. Hartshorne and P. Weiss, I: 54–56, Harvard Univ. Press, 1931, with the date guessed by the editors as "c. 1894" and with no reference to Secretary Langley. Hume is criticized by Peirce's reference to mathematics as "a large part of philosophy" and to "simple" observations as not easy because they are permeated with uncriticized opinions.

[12] *Ibid.* VI: 356–369, 1935. Here the editors guessed the date correctly "c. 1901" but were still unaware of the Peirce-Langley correspondence and the Peirce manuscripts of June 1, 1901 and September 5, 1901 reproduced below.

[13] I owe to my friend, Mr. Jerome Rosenthal, the suggestion that Peirce and James were impressed by the Curies' discovery of radio-activity (1895) and De Vries' *Die Mutations Theorie* (1901) as evidences of internal energy that seemed to be independent of the environment, and hence evidence of internal relations that transcend external "mechanical" forces.

2. THE PEIRCE–LANGLEY CORRESPONDENCE

Milford, Pa. 1901, April 1

My dear Professor Langley:

I have been studying your Reports, and I think I understand just what you want the Appendices to be. I write now to persuade you to employ me to write, say, 12000 words for your next report upon a subject on which I have much to say which would really be useful to a great many people; and it would be a pity if, after the many years of hard thinking that I have devoted to making the matter clear to my own mind, the results which could be put into a very forcible and clear statement, amounting to proof, should die with me, or go unexpressed until my powers decay. What I mean is the nature of scientific reasoning. It is singular that men who are very exact in their conceptions upon other subjects, such as Poincaré,—I don't mention logicians who are only superficially exact in any of their thinking,—should not only deem loose and desultory thought about the relations of theories to facts and like subjects to be permissible, but even have a notion that thinking of that sort on those subjects is particularly commendable. I should undertake to convince thinking men that that whole method,—as well as other methods that are in vogue, the psychological, the grammatical, —are wrong. That it is necessary to begin by ascertaining upon what principles the doctrine of legitimate inference should rest, and to adhere to them. Then I should go on to show what it must rest upon, namely, upon experience; but no desultory experience but experience of certain kinds and treated in a certain way. Then I would show that this method leads to definite practical and useful maxims. . . . [—C. S. Peirce]

April 3, 1901.

My dear Mr. Peirce:

I have your letter of the first, and I enclose you a circular used here in obtaining the counsel of persons attached to the Institution, in selecting magazine and newspaper articles already published, as an appendix to the Secretary's Report, to explain to you what that is.

I make no question whatever of your eminent fitness to treat, in an article for matured scientific minds, the subject you mention. I feel equally certain, however, that you do not appreciate the incapacity in the audience to whom the Appendix to the Secretary's Report is addressed, to understand any such subject, which, indeed, could hardly be made intelligible to them by the most extreme skill in popular elucidation. I do not suppose you would undertake to make an interesting newspaper article out of such a treatise, or to make the subject entirely comprehensible to an intelligent schoolboy or schoolgirl of fourteen; yet this is scarcely an exaggeration of the needs of an article for this special purpose.

The original article by Poincaré, to which you refer, was accepted by me without reading, at the suggestion of some one else. I think your translation a very able condensation and paraphrase of it but I should hardly wish to publish another such original paper.

The article on "Pearson's Grammar of Science" is valuable, but it would go miles above the heads of the audience to which I have already referred. I thank you for sending me the copy of the Popular Science Monthly, which is returned to you under separate cover.

I have borrowed liberally for a future volume, from the centennial reviews in the New York Evening Post and elsewhere, and among others your article on "The Century's Great Men in Science."

I take the occasion to say that I still remember with pleasure my reading of your first paper on "The Fixation of Belief," in the Popular Science Monthly of nearly twenty five years ago.

Very truly yours,

S. P. Langley,
Secretary.

P.S. Would you care to write an article of one, or at most, two thousand words, on the "Laws of Nature," as understood by Hume's contemporaries and by our own, with special reference to his argument on miracles: write it, I mean, in the untechnical speech which is so lucidly clear in the article I have just referred to?

Milford, Penn. 1901, Apr. (10)

My dear Professor Langley:

I have done the best I could with the subject you set for me, and enclose the result. It belongs, however, to an entirely different class of topics from those which I profess to be able to bring within the comprehension of the common farmer. Having lived among farmers for a great many years, and having carefully studied their ways of thinking, I know how to talk to them about anything within their comprehension. Logical subjects, if taken up in their proper order, are quite within their comprehension, because every step

can be illustrated by a reasoning sufficiently like those upon which they have to think hard and anxiously every year. I know better than to insult them by drawing my examples as if they were able to think of nothing but farming; but I make my illustrations precisely analogous to reasonings of their own. I have very often written for them in the journals they read to their high satisfaction.

As to treating logical topics in newspaper articles, of course that is precisely what I am constantly doing; but the city daily paper addresses a totally different kind of intelligence from the country weekly.

As for boys of 14, they are incomparably below the farmer in logical intelligence, because they never have done any very serious and strenuous thinking. On other subjects I have had much success in writing to them.

Readers of Smithsonian Reports form a class rather different from farmers, and in some respects more intelligent. Still I do not think it would be possible to discuss before them to any advantage a question of metaphysics, such as is that which you assign to me to write about. Probably you regarded it as a scientific question. To my mind, it is quite clear that it is a question upon which no special science can throw any particular light, although the scientist has to make some sort of assumption about it.

I have just multiplied the space you gave me by two, so as to bring the task a little nearer to the region of possibility; and in that space, I have treated the subject as nearly as possible so as to be of benefit to your readers. Probably it might do *some* of them good to read what I have written.

I am glad you find my Pop. Sci. Monthly article so totally unsuitable for your readers. It was written for a totally different class, which I carefully defined in my letter to you, and had it been the least suitable to your readers, it must have been utterly unsuitable to those for whom it was intended. I exhibited a boat of my making as evidence of my handiness with tools, and your comment upon it was that it would not do for a rat-trap at all. I should hope not!

Although I forward what I have written, I do not think it very suitable for your readers. The subject set me was too impossible. So you need feel under no obligation to keep it.

If you do not like the idea of my writing for your readers about logic, about which I have much to say which they would understand, is there not a "first-intentional" subject upon which you would accept an article from me? Suppose, for example, I were to describe my method of studying great men, which is elaborate and interesting?

Although, as you can see, I am far from charmed with the subject you assigned to me, and not altogether reconciled to your rejection of the subject I would have liked to write about, yet I beg you, my dear Prof. Langley, to understand that I fully appreciate the great kindness and friendliness with which you treat me, and that I am deeply grateful for the material succor which it brings and of which I am very much in need, indeed. My wife whom I sent to N. Y. to see the doctors, came back with their verdict that a second great operation has to be performed just as quick as she can be brought up into condition to undergo it.

Yours very faithfully,
C. S. Peirce.

April 19, 1901.

Dear Mr. Peirce:

I asked you in my letter of April 3d, to write, in untechnical speech, a short article on the "Laws of Nature," as understood by Hume's contemporaries and by our own, with special reference to his argument on miracles.

I have read with interest and profit the article you sent me, and I shall be pleased to keep it and to publish it later. I wish, however, that you would please note that I asked this with special reference to Hume's argument against miracles, which is only indirectly alluded to in your treatment. Hume says: "A miracle may be accurately defined a transgression of a law of Nature by a particular violation of the Deity, or by the interposition of some invisible agent." (Hume, *Human Understanding,* Of Miracles, x, note.)

The question turns on the interpretation of the words "law of Nature," and I am seeking an expression for the difference in the argument of educated thought in Hume's time and in ours. Hume's contemporaries,—by which I mean not so much the few professional philosophers, as the common of educated men in his generation,—would doubtless not think of a law of Nature as the expression of an observed sequence or they would not use such a term as the "transgression" of a law. Rather would they, I think, impute to the "law" in respect of both its origin and its execution, the qualities of an Act of Parliament. I believe, then, that this contemporary argument, which once seemed so strong and which in my own recollection was almost considered conclusive, even by

those who most disliked its conclusion, would have very little weight even with those who are prepared by their wishes to discredit the miracles. To the common of educated men a "law of Nature," I think, is now coming to mean a statement of an *apparent* sequence in Nature, which is only important as far as it has been correctly observed and interpreted by the fallible human mind.

In other words is it not recognized now that it is a question of the degree of evidence on which the law rests? Huxley is prepared to tell us how much and what kind of evidence will persuade him that a Centaur may be expected to be seen trotting down Piccadilly!

Now I should be glad if you could add a few words to what you have said, concerning the change of the common view about the meaning of the laws of Nature between Hume's time and our own; it is the insistence of this distinction, provided that you can agree to the fact that it exists, and a statement of it in your own more exact language, that I would very much like to get as an addition to what you have already said.

Very truly yours,

S. P. Langley,
Secretary.

Milford, Pa. 1901. Apr. 20.

My dear Professor Langley:

I have just received yours of 19th with my screed, and regret that I should have misunderstood your desires, which you now make plain to me. I shall have to write quite a new article, which will not prevent your taking the one I have already written, if you like; but as I said before, there is no obligation. I must re-read several things before writing, and I have no books here, not even a Hume. I shall have to go to New York.

Meantime, I can say that there is no great significance in the occurrence of the word *law* in Hume's definition of a miracle. His definition was drawn directly or indirectly from Aquinas, who says, "miraculum propriae dicitur, cum aliquid fit praeter ordinem naturae."[1] Of course, "law of nature" meant something entirely different for Aquinas. In fact, it was so, even in Hume's time, out of England, as one can see from Baumeister (1738) who says "Miraculum est, cujus ratio sufficiens in essentia et natura entis non continetur,"[2] and who goes on, in this connection to define *ordo naturae,* and *cursus naturae,* but not at all *lex naturae,* about which he only talks in connection with ethics. However, it was different in England and in a measure in France. The expression law of nature is as old as Pindar in Greek, as Lucretius in Latin. But until modern times, it was used, as "law" ought to be, of something that *can* be broken but *ought* not to be. On the other hand, our *idea* of a law of nature was not foreign to the Greek mind. Only, the difficulty was that everybody then thought about Physics what today everybody but me and a select few think about Logic, namely, that minute and exact studies were out of place, and that broad and rough sketches were wanted. Thus Cicero, De Natura Deorum, says: "Alii naturam censent esse vim quondam sine ratione, cientem motus in corporibus necessarios: alii autem, *vim participem* rationis, atque *ordinis;* tanquam via progredientem, declarantemque, quid cujusque rei causa efficiat, quid sequatur, cujus sollertium nulla ars, nulla manus, nemo opifex consequi possit imitando."[3] I believe that the modern application of the word "law" to something that cannot be broken, took its rise from Descartes, with his undeveloped occasionalism. He said the three angles of a triangle were equal to two right angles, because God chose to have them so; while he held at the same time, that all the purposes of God, without exception, are alike inscrutable. In Boyle, we see this very idea leading, as it naturally would, to the phrase *law of nature,* in the modern sense. See his Free Inquiry into the received Notion of Nature. Section vii. "Nature is not to be looked on as a distinct or separate agent, but as a rule, or rather a system of rules, according to which those agents, and the bodies they work on, are, by the great Author of things, determined to act and suffer. . . . We may usefully distinguish between the *laws of nature,* more properly so called, and the custom of nature, or, if you please, between the fundamental and general constitutions among bodily things," etc.

Returning to miracles, Bishop Butler, in his Analogy, 1736, holds it to be presumable that miracles follow certain higher laws.

[1] "Miracle in the strict sense is used when something takes place outside the order of nature."

[2] "Miracle is that whose adequate cause (sufficient reason) is not contained in the essence and nature of the thing."

[3] Some consider nature at certain times an irrational force exciting necessary motions in bodies; others again, as a force endowed with reason and order, declaring she acts according to a plan which is the cause of the thing, and whose skill no art, no hand, no artisan can accomplish by imitating."

The fathers of the church use no metaphysics in defining miracles. Thus, St. Augustine says, "Miraculum voco, quicquid arduum aut insolitum supra spem et facultatem mirantis apparet." [4]

Hume's argument does not turn upon any metaphysical definition, any more than that of Woolston did. There is some force in the argument. But he makes the balancing of probabilities the sole consideration in judgment concerning testimony. From the pragmatical principle, which I still regard as highly useful, although not as the ultimate principle, a different conception of the function of hypothesis and of the logic of hypothesis necessarily results. As I have been in possession of this doctrine of the logic of hypothesis for five or six years, carefully considering and criticising it, and am now quite ready to publish my conclusions, I shall be very glad to have an opportunity to do so. I make the question of probability a secondary factor.

As to the state of the public mind at the time of Hume, as compared with that of today, I cannot speak with so much confidence. Nevertheless, I think the emptiness of the churches shows that miracles are less believed now. At the same time, my own impression, for which I can give some reasons, is, that the pendulum is now swinging the other way.

To say what is the cause of such phenomena is far more difficult, if not quite idle, at present. But I certainly do not think it comes from any deep thought or from any cause for which a rational thinker need entertain any respect. It is easy enough to suggest possible explanations in plenty.

Holding, as I do, that there is no intimate connection between the conception of the Laws of Nature and Hume's argument against miracles, I think you can understand how when you asked me to treat of "the Laws of Nature as understood by Hume's contemporaries and by our own, with special reference to his argument on miracles," I quite failed to see that it was a *logical* question about Hume's argument against miracles and not the *metaphysical* question of *law* which you wanted me to make my principal subject. I much prefer to do so.

Yours very truly,

C. S. Peirce.

If your Disbursing Agent would send that $4. it would pay my fare to N. Y. and return. I have had to pay off more than half my mortgage this spring amounting to $1700 and had to dump every cent I got from you into that. Then I had a suit which I felt confident would bring me $800. Unfortunately one of our "Lay Judges" had a suit against the same party, and thought if I got all that, there would not be enough left for him, and he managed iniquitously so that I only get $200, not enough to pay expenses hardly. I can appeal; but meantime, I am just as hard up as can be, with Mrs. Peirce's operation coming shortly.

[4] "Miracle, I call, what seems to one difficult or unusual, surpassing his ability and expectation."

April 23, 1901.

My dear Mr. Peirce:

I have your letter of the 20th, which I have read with interest. I only write now to enclose the $4. you refer to, and to say that the manuscript which you offered, I will take, and that it was returned to you through some error. I do not know how many words there were in it, but if you will accept an honorarium of Twenty Dollars ($20.00), with the understanding that this is quite independent of the payment for the new article, I am pleased to enclose it.

Very truly yours,

S. P. Langley,
Secretary.

(Undated) Received May 13, 1901.

My dear Professor Langley:

On careful consideration of the matter, I have decided that the only possible way of discussing the question you propose in your Appendices, is to separate it into at least three chapters and even then those chapters must be quite long. They may be made so far independent that they can be published in different years.

I now send you one, the first one. It would be much clearer if it were half as long again,—because the sequence of thought could be better enforced upon the reader unaccustomed to consecutive thought. It would be still better for all classes of readers if another considerable addition were made to it in order to give historical illustrations. In fact several of these I actually wrote, but cut them out to save space.

Let me say again that you are not obliged to take the thing. As it is, it is no doubt hard reading. Yet there [are] bits of it that may please the readers who really don't understand it.

My plan would be to add another on the Rationale of Historic Criticism and finally wind up with the one sent back to me which I retain in order to improve it.

I was in New York eleven days hoping to earn a sum much needed. Unfortunately the gentleman for whom I worked very hard and increased greatly the value of his extraordinary library by my discoveries (as he fully acknowledged) took the view that as I was a personal friend and under obligations to him it wasn't necessary for him to pay *more* than my expenses, if quite that. He said he thought he had paid half my expenses. In fact, it was rather more than the total, but not so much as I could have earned in, say, driving a team. However, I must not permit myself to blame my friend. I mention it merely to show that if so be as any further money could be sent, I should be relieved. I fear I did not write and thank you for your splendid response to my previous appeal. If I did not, it was because I went off in a great hurry and was working day and night all the time I was gone.

I found a magnificent passage from St. Augustine about miracles, saying substantially what Bishop Butler said, but saying in Augustine's grand style that we cannot really know what is or is not in true accord with the course of nature.

I met in New York an old friend of mine, a Frenchman, who told me how he had known very well the elder Alexandre Dumas, who used to come to his country place. I remarked that Dumas must have been a splendid shot. On the contrary, said he, he was a remarkably bad shot. A new proof of the brilliancy of his imagination.

Very truly and with particular gratitude for your prompt response,

C. S. Peirce.

May 18, 1901.

My dear Sir:

I am instructed by the Secretary to acknowledge the receipt of the manuscript of your article on "The Proper Treatment of Hypotheses," which he has read through with much interest. The Secretary agrees with the statement which you make in your accompanying letter, however, that the article is "hard reading," and quite beyond the scope of the readers for whom the Appendix to the Secretary's Report is intended. You will remember that he sent you, with his letter of April 3d, a circular explaining the untechnical and popular character of the papers for the Report, and expressed the fear that you might not "appreciate the incapacity in the audience to whom the Secretary's Report is addressed, to understand any such subject, which, indeed, could hardly be made intelligible to them by the most extreme skill in popular elucidation." He went on further to say that while he could hardly ask you to make an interesting newspaper article out of such a treatise, or make the subject entirely comprehensible to an intelligent schoolboy or schoolgirl of fourteen, yet that this was scarcely an exaggeration of the needs of an article for this special purpose.

It is manifest, after this explanation, that the manuscript which you forward is hardly acceptable for publication in the Report, and the Secretary regrets that he is therefore obliged to return it to you.

The Secretary asked in his letter of April 3d, that an article of not more than two thousand words should be prepared. In his letter of April 19th, of which he encloses a copy, he wrote more explicitly, and he now adds that if you can send him back this article or a new one keeping closely to the text, which may be the title "What is a Law of Nature?" written with special reference to Hume's argument and to the fact that this no longer carries, at least to the common reader, the weight that it once did, he will be pleased to receive it. He would be very glad to have you include in it the quotation from Saint Augustine, on miracles, of which you speak.

The Secretary is willing to pay for such an article, provided it does not exceed four thousand words, at the rate of twenty dollars ($20.00) a thousand, without any reference to the honorarium previously bestowed; always understanding, however, that the style of the article must be untechnical and such as would be suited to the columns of a newspaper like, for instance, the New York "Evening Post" or "The Nation."

Very respectfully yours,

F. W. Hodge,
A. C. O.

Milford, Pa. 1901, June 1

My dear Professor Langley:

Your returning me a copy of your former letter leads me to believe that you supposed I had not read it attentively.

That was not it. Certainly nothing can be farther from my desire than to quarrel with any task you may set me, but the difficulty of bringing subjects so remote from one another, and so complex, as Hume's argument and the Laws of Nature into one piece was extreme. *Hume's argu-*

ment has nothing to do with the Laws of Nature. That is the difficulty.

I now send you another attempt. I have made pencil marks of different colors along the margin against different classes of parts which could be omitted. Omitting all these parts, it contains on a rough estimate 3200 words. I think you may be yourself interested in reading the whole of the marked parts, and may very likely wish to include some of them. I therefore give my estimate of the number of words contained in each: Marked in yellow 1800 words. . . .

I have withheld some notes containing chiefly quotations. If you want to see them, I will send them.

It is pleasing to see a man with Jannsen's spirit. Thanks for your communication to the C. R. [*Century Review*]

Very respectfully, C. S. Peirce

June 21, 1901.

My dear Mr. Peirce:

Your letter of June 1 and the enclosed manuscript are brought to my attention on my return to the Institution after an absence of some days. I have read the manuscript with much care and interest, and have no hesitancy in saying that the article is extremely valuable in many respects. Much of it is perfectly unmanageable, however, for the audience for whom I intend it, and I have thought it best to again send it back to you and to ask whether it is not possible to furnish some equivalent, for the technical phrases which, if not exact, will at any rate meet the requirements of ordinary speech.

Knowing the special audience for which the paper is intended so well, I can safely say that not one in ten of them could tell what "prognosis" means, for instance, without consulting a dictionary. Can we not say "forecast," and so on?

In this connection I will ask you to please go over the manuscript, having prominently in mind the statement in my letters of April 3 and May 18, that for this special audience it would hardly be exaggerating to say that nothing is wanted which will not be "entirely comprehensible to an intelligent schoolboy or schoolgirl of fourteen."

I am so persuaded that I have not made my wish clear to you,—I have such a strong personal interest in this paper and am so very desirous of having the idea which I have outlined in my letters of April 3 and May 18, clearly set forth, that I have addressed to you in this same mail a separate letter in which I have endeavored to state my impressions more clearly and at somewhat greater length. The considerations therein mentioned as to the little effect of contemporary philosophy on the movement of human thought, you may not agree to, but they are those at least which I had in mind in asking you to write a short essay on the "Laws of Nature" as they seemed to Hume's contemporaries, and our own, with special reference to his argument on miracles.

I repeat that these are the things which have led me to ask you to take Hume, whose contemporaries, (however godless) nearly all deified the "Laws of Nature," as an example of what I mean by the change.

[—S. P. Langley]

1901, July 20

Dear Sir:

I have received duly the typewritten copy of my paper together with the original. The matter reached me last night.

I am gratified at the skill with which the cutting has been done. I shall do the necessary patch work early in August, not modifying much the way you leave it. But I have only gone through the thing somewhat cursorily. There will probably be some details in which I may like to strike a resultant between two proposals.

Very respectfully, C. S. Peirce

Milford, Pa. 1901 Sept. 5

Dear Sir:

I enclose herewith the typewritten copy of my paper which I have patched where severed by excisions, as I was desired to do; and if my connective tissue seems anywhere in excess, if you will have the kindness to indicate how you would like it altered (of course, not the *doctrine*), I don't in the least begrudge any amount of work. I think it very likely that suggestions from you may lead to material improvements; and if so, I desire to make them. Meantime, if I recollect rightly, it was about June 1 that I sent on this MS, which I now return along with the typewritten copy (and two cancelled pages of the latter) and I confess I should not be averse to a little money.

I have restored substantially the title I gave to my MS. ["The Laws of Nature and Hume's Argument Against Miracles"]. I attach great importance to this point; and I feel sure you will yield to my wishes in the matter when I tell you

that I consider it to be a question of fair treatment. Permit me to explain why I so consider it. Had I accepted a commission to write upon the subject of the new title you give to my paper ["On the Meaning of the Words 'Laws of Nature' in Modern Scientific Thought"], which I would not have done without a strenuous endeavour to have the false implication that the phrase "Law of Nature" figures in scientific thought removed, I certainly should have said nothing about the totally foreign matter of Hume on miracles (as I certainly consider it to be), still less should I have disgraced myself as a student of philosophy by representing Hume's doctrines as unfavorable to a view of the Laws of Nature which has no other source than precisely those doctrines. Moreover, I was, as you know, extremely undesirous of joining in one paper talk about two things which in my opinion have scarcely any discoverable connection. This however was forced upon me. Now every artist knows that to have outside restrictions forced upon him is unfavorable to good work, and that the very worst of such restrictions is to be required to make a composite subject whose parts are utterly unfit to be treated together. It would be extremely unfair to me to conceal the fact that the great fault of the paper, its composite subject, was not mine. I think that by the exercize of some ingenuity I have contrived, notwithstanding the subject, to draw up a paper not without value. But it remains a disjointed thing, as it could not fail to be.

Very respectfully, C. S. Peirce

[The next letter was written after the entire affair of Peirce's differences with Langley on the the subject of Hume and the laws of nature had been consigned to the files of the Smithsonian Institution. Langley in his reply which terminates the correspondence regretted that he had no authority over the trustees of the Carnegie Institution, and could not help Peirce. Peirce never received a Carnegie grant.]

Milford, Pa. 1902, May 6

My dear Langley:

I wish you could give me some employment for a few months. I have lately written a section of my big book on logic, this section dealing with the Classification of the Sciences. How much thought and labor has gone into it, you will understand when I tell you that the MS is 50,000 words long, and that in preparing it I consulted very close to a hundred different schemes that had been proposed. I am not entirely satisfied with what I have done and am now at work examining how scientific men in different branches felt themselves affiliated. This may lead to my making some changes.

I don't undertake to classify all possible sciences, but to produce a *natural* classification of the sciences as they now exist.

I think if I were to revise the work and bring it down to about 25,000 words, there are various classes of men, librarians, arrangers of sections of scientific societies, and scientific men of all kinds, who would be thankful to have it.

It is confined to the theoretical sciences, and does not include technology. To classify that would be a tremendous task. I have done a good deal of work on it. But my classification includes not only the psychical sciences, ethnology, linguistics, history, etc. but also the philosophical sciences and mathematics. It is carried out quite minutely.

Another subject on which I could give you an essay would be the different theories now held concerning the connection between soul and body, and the nature of the soul, glancing at unconscious mind. I have a new theory of the relation between body and soul which I have not yet published or said anything about. Whether it is correct or not is a question which elaborate researches would be necessary in order to ascertain; but the mere possibility of the thing at once knocks the bottom out of the principal argument for "psycho-physical parallelism," which is the theory most widely entertained at present.

I have been working on this big book pretty steadily since last summer, and have a large mass done; but it is but a small fraction of the whole. Some friends have been buying the copyrights of the separate parts in order to enable me to go on. But their money has given out. Since it will represent about forty years of industry, I am strongly in hopes the Carnegie Institution will do something for me in the autumn. Under clauses 1, 2, and 6 of Carnegie's statement of the purposes of that institution, it seems to me their plain duty to enable me to get this work done. But some of the trustees are determined to put me down.

I hate to break off this work. There will be waste in doing so. If I could get something to write for you which would tide me over, writing on some subject allied to those of my book, it would be a great thing for me.

Law
1

Hume on Miracles and Laws of Nature. 1904. 10

By C. S. Peirce.

I. What is a Law of Nature?

This phrase is used by physicists pretty vaguely and capriciously, in several respects. It is felt to be particularly appropriate as the designation of a physical truth of a widely general kind, exact in its definition, and found to be true without exception, to a high degree of precision. Yet there are truths of this description to which the title is refused; while others, special, rough in their statement, merely approximate in their truth, even subject to out-and-out exceptions, are nevertheless, so called.

But there are two common characters of all the truths called laws of nature. The first of these characters is that every such law is a generalization from a selection of observations; the principle of the selection having reference to the outward conditions under which the observations were made, and not to those results of them which are taken as the

Laws
2

subject of generalization. That is to say, we do not cull those observations which show any peculiarity, and then call it a "law of nature" that they show the very peculiarity which they were selected for showing.

The second character is that a law of nature is neither a mere chance coincidence among the observations on which it has been based, nor is it a subjective generalization but is of such a nature that from it can be drawn an endless series of prophecies, or predictions, respecting other observations not among those on which the law was based; and experiment shall verify those prophecies, though perhaps not absolutely (which would be the ideal of a law of nature) yet in the main. But my expression "subjective generalization" calls for explanation. Augustus De Morgan very simply demonstrated that, taking any selection of observations whatever, propositions without number can always be found which ~~are~~ shall be strictly true of all those observations (and I can add), propositions not going

FIG. 1. Pages 1–2 of Peirce's holograph submitted with his letter to Langley, June 1, 1901.

Laws 3

beyond the matter of the observations), and yet no one of them likely to be true of any other observations which the same principle of selection might add to the collection. Such a generalization, a mere fabrication of ingenuity, which I term a subjective generalization, is often proposed by an amateur in science as an induction. "Bode's law" was a subjective generalization. Let the artificers of such false inductions dare to set up predictions upon them, and the first blast of nature's verity will bring them down, houses of cards that they are.

So, then, I do not think a better definition of a Law of nature can be given than this: it is a prognostic generalization of observations.

forecasting

This said, the question is instantly started, How can the reason of a man attain to ~~prognosis~~ such forecasting?

How shall we answer? Must we not say that the fact that he can so attain, proves that there is an energizing reasonableness that shapes phenomena in some sense, and that

Law 4

this same working reasonableness has moulded the reason of man into something like its own image? These questions must remain for the reader to decide to his own satisfaction.

II. What conception of a Law of Nature was entertained in England in Hume's day, not by those who wrote upon the subject, but by the silent mass of educated men?

In Hume's day, more than at other times, the great mass of educated Englishmen were grossly "practical." They did not waste thought upon anything not pretty directly concerning their own comfort, security, or amusement. They went to church, because doing so set a good example to the people, and so tended to maintain the supremacy of the upper classes. That was commonly regarded among university graduates as the chief function of the church; and consequently, anything that tended to weaken the church awoke in such men horror and dread.*

*For a picture of Oxford in 1721, see Amhurst's 'Terræ Filius'.

FIG. 2. Pages 3–4 of Peirce's holograph submitted with his letter to Langley, June 1, 1901.

(People often write to me to ask me to write about the new doctrines of multitude, number, continuity, geometry, on which I have much to say, but I cannot say it because all my time has to go to bread and butter.)

Mrs. Peirce is in an extremely critical state of health, in which it is most necessary she should have the luxuries that her physician prescribes; and that is an additional reason why I should think only of work that brings in something. There is a lot of work people want me to do, which is right in my line, but they are unable to keep me alive while I do it.

Yours faithfully, C. S. Peirce

3. THE LAWS OF NATURE AND HUME'S ARGUMENT AGAINST MIRACLES [1]

BY C. S. PEIRCE

I. *What is a Law of Nature?*

Having consented to write upon the subject or two subjects of this paper, I begin by remarking that [2] this phrase "Law of Nature" is used by physicists pretty vaguely and capriciously, in several respects. It is felt to be particularly appropriate as the designation of a physical truth of a widely general kind, exact in its definition, and found to be true without exception, to a high degree of precision. Yet there are truths of this description to which the title is refused; while others, special, rough in their statement, merely approximate in their truth, even subject to out-and-out exceptions, are nevertheless, so called.

But there are two common characters of all the truths called laws of nature. The first of these characters is that every such law is a generalization from a [3] collection of results of observations, *gathered* upon the principle that the observing was done so well to conform to outward conditions; but not *selected* with any regard to what the results themselves were found to be;—a harvest or a gleaning of the fruit of known seed, not culled or select, but fairly representative.

The second character is that a law of nature is neither a mere chance coincidence among the observations on which it has been based, nor is it a subjective generalization, but is of such a nature that from it can be drawn an endless series of prophecies, or predictions, respecting other observations not among those on which the law was based; and experiment shall verify these prophecies, though perhaps not absolutely (which would be the ideal of a law of nature), yet in the main. Nor is a proposition termed a "law of nature" until its predictive power has been tried and proved so thoroughly that no real doubt of it remains.[4] But the [5] expression "subjective generalization" calls for explanation. Augustus De Morgan very simply demonstrated [6] that, taking any selection of observations whatever, propositions without number can always be found which shall be strictly true of all those observations (and it may be added that they may be propositions not going beyond the matter of the observations), and yet no one of them likely to be true of any other observations which the same principle of selection might add to the collection. Such a generalization, a mere fabrication of ingenuity, which I term a subjective generalization, is often proposed by an amateur in science as an induction. "Bode's law" [7] was a subjective generalization.

[1] Peirce's holograph, 55 autoscript half-pages (hereafter designated as AS), sent with his letter of June 1, 1901, was entitled "Hume on Miracles and Laws of Nature." It was changed by Peirce to the one printed in the text above after he crossed out Langley's suggested title: "On the Meaning of the Words 'Laws of Nature' in Modern Scientific Thought." (See letter of Sept 5, 1901.) The numbered footnotes indicate how Peirce's autoscript of June 1, 1901 differs from his final draft of Sept. 5, 1901 in the combined version printed here. Peirce's footnotes bear asterisks.

[2] Peirce's AS begins here: "This phrase is used by physicists . . .," which Peirce changed in the final draft to the opening clauses printed above.

[3] From here to the end of the paragraph, Peirce's AS reads: ". . . selection of observations; the principle of the selection having reference to the outward conditions under which the observations were made, and not to those results of them which are taken as the subject of generalization. That is to say, we do not cull those observations which show any peculiarity, and then call it a 'law of nature' that they show the very peculiarity which they were selected for showing."

[4] This sentence beginning with "Nor" is not in AS; it was added by Peirce in final draft.

[5] AS: "my" instead of "the."

[6] A. DeMorgan (1806–1871). *Cf.* article "Logic" in the *English Cyclopedia* (1860), *Essay on Probabilities* (1838), *Formal Logic, or the Calculus of Inference, Necessary and Probable* (1847), but I cannot find the exact location of DeMorgan's demonstration to which Peirce refers.

[7] *Cf.* J. Jeans, *The Universe Around Us,* 237–238: N. Y., Macmillan, 4th ed., 1944, "Modern science is no longer concerned to look for numerical order in the distances between the planets, but is very much concerned to see whether the various observed regularities can be explained on evolutionary lines as the result of the operation of natural forces." Bode's Law (1772) has the form $d = 4 + 3.2^n$ where d is the distance of a planet from the sun, taking the earth's distance as 10, and n is the order of the planets. The "law" fails badly for Neptune and Pluto.

Let the artificers of such false inductions dare to set up predictions upon them, and the first blast of nature's verity will bring them down, houses of cards that they are.

So, then, I do not think a better definition of a *law of nature* can be given than this: it is a foreknowing [8] generalization of observations.

This said, the question is instantly started, How can the reason of a man attain such foreknowledge? [9]

How shall we answer? Must we not say that the fact that he can so attain, proves that there is an energizing reasonableness that shapes phenomena in some sense, and that this same working reasonableness has moulded the reason of man into something like its own image? These questions must remain for the reader to decide to his own satisfaction.

II.[10] *What conception of a Law of Nature was entertained in England in Hume's day, not by those who wrote upon the subject, but by the silent mass of educated men?*

In Hume's day, more than at other times, the great mass of educated Englishmen were grossly "practical." They did not waste thought upon anything not pretty directly concerning their own comfort, security, or amusement. They went to church, because doing so set a good example to the people, and so tended to maintain the supremacy of the upper classes. That was commonly regarded among university graduates as the chief function of the church; and consequently, anything that tended to weaken the church awoke in such men horror and dread.*

The small remainder who really had any philosophical opinions, and yet did not write, were divided among three different ways of thinking. The Scotistic opinion, which had ruled the universities before the Reformation, had, in Hume's day, quite disappeared. That opinion, it is necessary to remember, had been that, in addition to Actual Existence, there are various modes of Imperfect Being, all of them varieties of Being *in futuro*,—which we talk of when we say that "Christmas *really is coming*"—and in one of those modes of being, it was held that there really was something, which we of today should call a "law of nature," but which in the Latin language is simply a "nature"; and the Being *in future* of this law of nature was held to *consist in* this, that future events would conform to it. The theoretical element in that opinion lay precisely in the supposition that that which the ordinary course of things is bound (if not hindered) to bring about, already has a Germinal Being. That was no scholastic invention: it was the very heart of Aristotle's philosophy. But in Hume's day, nobody any longer believed in any such thing as that.[10a]

In the last century an argument against miracles by David Hume attained celebrity and was generally regarded by the common of educated men as conclusive.[11] The great variety of attempts to answer it and their unsuccess [12] are the best evidence of the importance which attached to it in the century following its promulgation.

Briefly Hume accepts the definition of [13] a miracle which had become common in England in his day,[14] as a "violation of the laws of nature." It might be added that the whole of modern "higher criticism" of ancient history in general, and of biblical history in particular is based upon the same logic that is used by Hume.[15] He says there must [16] "be an uniform experience against every miraculous event, otherwise the event would not merit that appellation, and as an uniform experience amounts to a proof, there is here a direct and full proof from the nature of the fact against the existence of any miracle." This does

[8] AS: "prognostic." Langley changed this to "forecasting" which Peirce finally changed to "foreknowing," and in some passages (*infra*) to "predictive" and "forecastive."

[9] AS: "to prognosis" instead of "such foreknowledge." Langley had "such forecasting."

[10] Langley deleted some of the paragraphs in Part II of Peirce's AS and revised others. Peirce accepted with changes certain portions of Langley's version, after writing in the margin: "The simplest way is for me to adopt the paragraphs of Prof. Langley and make such modifications as seem to me called for." I refer to these changes by Peirce of Langley's version as "the final draft."

* For a picture of Oxford in 1721, see Amhurst's "Terrae Filius." [Footnotes marked by an asterisk are by Peirce.]

[10a] The next four paragraphs were added by Langley to AS, and then modified by Peirce.

[11] Peirce deleted from the rest of this sentence of Langley's version: "at least as against the Christian miracles," and wrote in the margin: "This is not my writing; but the men referred to were fully so much convinced of the absurdity of non-christian as of christian miracles."

[12] Langley had "uniform failure" which Peirce changed to "unsuccess."

[13] Langley had "defines" which Peirce changed to "accepts the definition of."

[14] Peirce inserted after "miracle": "which . . . day."

[15] Peirce inserted the foregoing sentence into Langley's version.

[16] Peirce inserted "there must," a typist's omission.

not exhibit the line of argument [17] which appeared so convincing to the century that followed Hume; but it is a curtailed statement given by Hume, no doubt for the benefit of those to whom the full argument seemed too abstruse.[18] Within the past generation, especially [19] within the past decade,[20] there have been symptoms that this true argument, and not merely this abridgment of it, is beginning to satisfy minds less completely than it used to do and that without having been refuted by any formal argument but partly because in some influential branches of science, it is out of harmony with modern ways of reasoning, and partly, no doubt, because archeological research has refuted so many conclusions to which the same method of reasoning had brought the critics of history. At any rate, whatever the cause may be, the argument is certainly falling from its high renown. Professor Langley is of opinion that what "Laws of Nature" are coming to mean to our contemporary thought we can assist ourselves to understand by considering the change of our attitude toward this argument.

Now, what conception of a "Law of Nature" was entertained in England in Hume's day by the mass of educated men?

It has often been remarked that the definition of a miracle as a contravention of the order of nature is self contradictory, because all we know of the order of nature is derived from our observation of the course of events of which the so-called "miracle" is a part.[21] St. Augustine, for example, in his glowing language, the Latin of the Vulgate, points out that it is only the order of nature so far as we can penetrate it that can be violated by a miracle; for the true order of Nature is the ordinance of God; and the usual definition of a miracle among the fathers of the church is a performance which seems clearly to be beyond the power of man without divine assistance. In fact, the argument of Hume in no way turns upon any metaphysical definition of a miracle. Had it done so, it would have been refuted easily enough. It is, indeed, not properly an argument against miracles, in general, but only against *historical* miracles; and Hume does not lay himself open to so puerile an objection as that "all we know of the order of nature is derived from our observation of the course of events of which the so-called miracle is a part"; for nobody was more alive to that than he. It was against those miracles which did *not* form a part of our perceptual data, but were only hypotheses to account for the testimony of documents, that his argumentation was directed. Precisely, the same line of reasoning can be, and frequently is, applied to extraordinary events that are not miraculous. The reaction of thought which now prevails consists in a suspiciousness concerning all reasoning of this description. The suspicion is thoroughly justified. The reasoning which Hume defends as highly scientific and as based upon mathematical principles, is shown by modern exact logic to amount to nothing but a peculiarly unfounded sort of presumption, only permissible in the extremest cases; and its pomp of mathematics is but a lion's skin disguising an obstinacy of adherence to preconceived opinions. But although it would thus appear that no two topics could be less germane, the one to the other, than Hume's argument and the conception of a law of nature, there is, nevertheless, a certain connection between them. Let us begin by examining the state of ideas in England in Hume's day.

The oldest opinion rife at that time was that of the Ockhamists, which was developed in the first half of the XIVth century, and has had a very strong following in England from that day even to our own, without yet betraying any great signs of enfeeblement. This opinion is, that there is but one mode of Being, that of individual objects or facts; and that this is sufficient to explain everything, provided it be borne in mind that among such objects are included *signs*, that among signs there are *general* signs, i. e., signs applicable each to more than a single object, and that among such general signs are included the different individual

[17] Langley's version: "This in briefest terms was the argument."

[18] The clause "but . . . abstruse" was inserted by Peirce.

[19] Langley's version "perhaps" instead of "especially."

[20] After "decade," Langley's version: "it seems to have lost its force in the eyes of scientific men and is losing it in that of the laity and without having been refuted by any formal argument but by the mere change of attitude of educated thought toward its underlying assumption. For now, if not entirely without weight it has at any rate ceased to influence men's opinions. What the laws of nature mean in our contemporary thought we can very well assist ourselves by considering the change of our attitude to this argument. Now, what conception of the law of nature was entertained in England in Hume's day by the mass of educated men? To sum up, as has been said by another, the definition of a miracle as a supposition or a contravention of the order of nature is self-contradictory, because all we know of the order of nature is derived from our observation of the course of events of which the so-called 'miracle' is a part."

[21] The rest of this paragraph was inserted by Peirce and is not in AS.

conceptions of the mind. This theory opens a labyrinthine controversy, full of pitfalls, which ninety-nine readers out of every hundred lack the patience to thread to the last; so that they finally leap the hedge and decide the question according to their personal predilections. I will simply aver, from having analyzed the whole argument, that the Ockhamists are forced to say of a law of nature that it is a similarity between phenomena, which similarity consists in the fact that somebody *thinks* the phenomena similar. But when they are asked why *future* phenomena conform to the law, they are apt to evade the question as long as they can. Held [22] to it, they have their choice between three replies.

The reply which the stricter Ockhamists usually give is that the conformity of future observations to inductive predictions is an "ultimate fact." They mostly endeavor to generalize this reply, so that, as they phrase it, it is the "uniformity of nature," or something of the sort, that is the ultimate fact. Such a generalization is inherently vague; and besides, a general fact has, for them, no being at all except as somebody's thought about its particulars; so that there seems to be no inaccuracy in saying that they make each fulfillment of a prognostication an "ultimate," that is to say, an utterly inexplicable, fact. But they cannot, and do not, maintain that the fulfillment of the prophecy is *self-evidently* an ultimate fact. Indeed, the Ockhamists are justly very chary of admitting "self-evidence." No, they admit that the "ultimacy" of the prognostication is their *theory* of it. But at this point, Logic puts in a demurrer. For the only possible logical justification that a theory can have, must be that it furnishes a rational explanation of the relation between the observed facts; while to say that a relation between observations is an "ultimate fact," is nothing more than another way of saying that it is *not susceptible* of rational explanation. That, one would think, ought to put this first answer out of court, at once.

There remain two other possible answers, though neither is much in the Ockhamistic taste. To the question how true prognostication was possible, an answer sometimes given in Hume's time was that it was rendered so "by the courteous revelations of spirits." If these were finite spirits, as some of the Cambridge men thought, one does not see how they could prognosticate better than their superior, redeemed man.

Finally, a quite common answer was that predictions [23] come true because God chooses so to govern the universe that they may come true. I term this style of explanation, that things happen as they do because God chooses that they shall so happen, "explanation *à la turque*." [24] It is a right handy contrivance for explaining all past, present, and future phenomena, without stirring from one's sofa, in one brief sentence which no monotheist can deny. Some may think it a disadvantage in this theory that it refuses to lend itself to any definite prediction, for all its making prediction such a simple matter. But then, it so escapes all danger of refutation. Ockhamists do not commonly attach much importance to prediction anyway, and often seem to hate to hear it talked about.

Under the head of Ockhamists I mean to include, first, Hobbes, more extreme than Ockham himself; then Berkeley, Hume, the Mills, etc.; [25] then Locke, and many others less decidedly of this turn of thought.[26] But the truth is that all modern philosophy is more or less tainted with this malady.

Another [27] philosophy which had some currency in England in Hume's time was the theory of a "plastic nature," that is to say, a slightly intelligent agent, intermediate between the Creator and the universe, God's factotum, which attended to the ordinary routine of administration of the universe. This theory was so much out of date that I should not have mentioned it were it not that I suspect it aided considerably in bringing into vogue the phrase "law of nature" in England, an expression which the sectaries of the plastic nature might very naturally, and in fact early did, employ. One of them, for example, Lord Brooke, in a work published in 1633, but "written in his Youth and familiar Exercise with Sir Philip Sidney," has the following:

> "And where the progresse was to finde the cause
> "First by effects out, now her regresse should
> "Forme Art directly under *Natures Lawes,*
> "And all effects so in their causes mould
> "As fraile Man lively, without School of smart,
> "Might see Successes comming in an Art."

[22] From "Held" to "a quite common answer" (three paragraphs below) was deleted by Langley from AS.

[23] AS: "prognostications"; Langley's version: "forecastings."

[24] Langley deleted "explanation *à la turque*."

[25] AS added: "typical Ockhamists, all."

[26] AS: "who are less decidedly Ockhamistic."

[27] This paragraph in Peirce's AS was deleted in Langley's version.

Here, "Nature's Laws" are nothing but prognostic generalizations of observations. However, a stray poetical example does not argue much.

Another philosophy, famous even in England, was that of Descartes, who made all connections between events to be due solely to the direct intervention of the Deity. In short, he held the explanation *à la turque* to be the only true one.[28] It followed that if we can attain any foreknowledge,[29] this is because the Deity has chosen somehow to make the order of events in some measure comprehensible to us. But the conclusion which Descartes *held* to be deducible, for he it was who set that fashion of loose reasoning to which all subsequent metaphysicians have so religiously conformed, went a good deal further; for from the bare thought "I think, and so I exist," he professed to demonstrate that whatever appears to us clear and distinct must be true,—another of those modern conveniences by which Descartes rendered philosophizing so reposeful! Meantime, one might expect that Descartes' opinion would lead to his calling predictive generalizations of observations by the name of "laws of nature"; and so, accordingly we read, in his *Principia Philosophiæ,* published in 1644: "Moreover, from this same immutability of God, certain rules, or laws of nature, can be known, which are secondary and particular causes of the different movements which we observe in bodies." * It will be observed that Descartes does not acknowledge that his laws of nature are generalizations from experience, although they are prognostic. He was as extreme in attributing almost the whole achievement of science to the light of reason as the Ockhamists are in altogether denying it any part in that achievement.

The branch of philosophy in which the Britain of Hume's time really takes a distinguished place was ethics. The great light at the time Hume's argument was published was Hutcheson. Hume considered his own greatest work to be his *Principles of Morals* (1751), which merely modified Hutcheson's doctrine. The book which reading Englishmen were talking most about when Hume's argument appeared was Wollaston's *Religion of Nature.* It had gone, I believe, through seven editions. Its main doctrine was that all vice is, at bottom, lying; and the one virtue, truthfulness. But as far as I am aware, there is little in all that literature to illuminate the problem we have before us.

In asking what speculations were passing in the minds of men who lived near two centuries ago, and never set pen to paper, I found myself before a pretty enigma. Still, having made my little research (all too hasty, I confess) I ought, at least, to know more about the matter than the average man. Now, however, I have to take up a question where I can only rely on personal observation within an area of acquaintance very likely no wider than my reader's,—perhaps less so. The question lies across my path, however, not to be avoided. I must briefly consider it.[30]

III. *What conception of laws of nature is entertained today by the generality of educated men?*

I should say, most commonly, the same Ockhamistic conception which was commonest in Hume's time; for most men whom I meet, when they refer to such matters, talk the language of Mill's *Logic.* In particular, the explanation of foreknowledge[31] most common is that it is rendered possible by the uniformity of nature, which is an "ultimate fact." This adapts itself well to the atheistic opinion which has always been common among Ockhamists,—more so, perhaps, about 1870 than at any other time.

Today, the idea uppermost in most minds is Evolution. In their genuine nature, no two things could be more hostile than the idea of evolution and that individualism upon which Ockham erected his philosophy. But this hostility has not yet made itself obvious; so that the lion cub and the lamb still lie down together in one mind, until a certain one of them shall have become more mature. Whatever in the philosophies of our day (as far as we need consider them) is not Ockhamism is evolutionism of one kind or another; and every evolutionism must in its evolution eventually restore that rejected idea of law as a reasonableness energizing in the world (no matter through what mechanism of natural selection or otherwise) which belonged to the essentially evolutionary metaphysics of Aristotle, as well as to the scholastic modifications of it by Aquinas and

[28] This sentence from Peirce's AS was deleted by Langley.

[29] AS: "make any prognoses" instead of "attain any foreknowledge."

* Atque ex eadem immutabilitate Dei, regulae quaedam, sive leges naturae cognosci possunt, quae sunt causae secundariae et particulares diversorum motuum, quos in singulis corporibus advertimus. Pars II, xxxvii.

[30] This last AS paragraph was deleted in Langley's version.

[31] AS: "prognosis."

Scotus.* To this wing of philosophy belongs, too, that theory of Gassendi which the present writer endeavored, a few years ago, to reawaken (in a perfected form), and of which, for the sake of the evolutionary conception of law which it illustrates, may here be inserted a description by an opponent of it, which was published in 1678:

"But because men may yet be puzzled with the universality and constancy of this regularity, and its long continuance through so many ages that there are no records to the contrary anywhere to be found, the atomic atheist further adds, that the senseless atoms, playing and toying up and down, without any care or thought, and from eternity trying all manner of tricks and conclusions and experiments, were at length (they know not how) taught, and by the necessity of things themselves, as it were, driven, to a certain kind of trade of artificialness and methodicalness; so that, though their motions were at first all casual and fortuitous, yet in length of time they became orderly and artificial, and governed by a certain *law*, they contracting as it were upon themselves, by long practice and experience, a kind of habit of moving regularly." Cudworth's *True Intellectual System of the Universe.*

IV. *What is the conception of law entertained today by typical scientific men?*

It does not belong to the function of a scientific man to ascertain the metaphysical essence of laws of nature. On the contrary, that task calls for talents widely different from those which he requires. Still, the metaphysician's account of law ought to be in harmony with the practice of the scientific man in discovering the laws; and in the mind of the typical scientific man, untroubled by dabbling with metaphysical theories, there will grow up a notion of law rooted in his own practice.

The scientific man finds himself confronted by phenomena which he seeks to generalize or to explain. His first attempts to do this, though they will be suggested by the phenomena, can yet, after all, be reckoned but mere conjectures; albeit, unless there be something like inspiration in them, he never could make a successful step. Of those conjectures,— to make a long matter short,—he selects one to be tested. In this choice, he ought to be governed solely by considerations of economy. If, for example, the prospect is that a good many hypotheses to account for any one set of facts, will probably have to be taken up and rejected, and if it so happens that, among these hypotheses, one that is unlikely to be true can probably be disposed of by a single easy experiment, it may be excellent economy to begin by taking up that. In this part of his work, the scientist can learn something from the business man's wisdom. At last, however, a hypothesis will have been provisionally adopted, on probation; and now, the effort ought to be to search out the most un-

* [Footnote added by Peirce to take the place of the rest of part III of AS, deleted by Langley:] The acute reader (and it has become known to me that the Smithsonian Reports number among their readers men who, though they be children in scientific methods, yet surpass the average of the great scientists in the precision and vigor of their thought) will ask what I mean by a "reasonableness energizing in the world." I do not *define* the reasonable as that which accords with men's natural ways of thinking, when corrected by careful consideration; although it is a *fact* that men's natural ways of thinking are more or less reasonable. I had best explain myself by degrees. By reasonableness, I mean, in the first place, such unity as reason apprehends,—say, generality. "Humph! By generality I suppose you mean that different events resemble one another." Not quite: let me distinguish. The green shade over my lamp, the foliage I see through the window, the emerald on my companion's finger, have a resemblance. It consists in an impression I get on comparing those and other things, and exists by virtue of their being as they are. But if a man's whole life is animated by a desire to become rich, there is a general character in all his actions, which is not caused by, but is formative of his behavior. "Do you mean then that it is a purpose in nature?" I am not insisting that it is a purpose; but it is the law that shapes the event, not a chance resemblance between the events that constitute the law. "But are you so ignorant as not to know that generality only belongs to the figments of the mind?" That would seem to be my condition. If you will have it that generality takes its origin in mind alone, that is beside the question. But if things can only be *understood* as generalized, generalized they really and truly *are*; for no idea can be attached to a reality essentially incognizable. However, Generality, as commonly understood, is not the whole of my "reasonableness." It includes *Continuity*, of which, indeed, Generality is but a cruder form. Nor is this all. We refuse to call a design reasonable unless it be feasible. There are certain ideas which have a character which our reason can in some measure appreciate but which it by no means creates, which character insures their sooner or later getting realized. What machinery may be requisite for this I do not ask. But the laws of nature have, I suppose, been brought about in some way; and if so, it would seem that they were of such a nature as inevitably to realize themselves. These, then, are the naked abstract characters that must be recognized in the "reasonableness" of a law of nature. Whether or no it be a legitimate presumption from those characters that nature has an intelligent author, I certainly do not see how the abstractions could, better than in that statement, be clothed in the concrete forms which many minds require, or how they could better be connected with appropriate sentiments.

likely necessary consequence of it that can be thought of, and that is among those that are readily capable of being brought to test of experiment. The experiment is made. If the prediction from the hypothesis fails, its failure may be so utter[32] as to be conclusive; or, maybe, nothing more than an alteration of the defective theory need be undertaken. If, notwithstanding its unlikelihood, the prediction be verified, and if the same thing happen again and again, although each time the most unlikely of the (convenient) predictions has been tried, one begins to doff one's cap to the rising star that nature herself seems to favor.

The scientific man certainly looks upon a law, if it really *be* a law, as a matter of fact as objective as fact can be. The only way in which, to the scientist's apprehension, a newly recognized law differs from a fact directly observed is, that he is, perhaps, not quite sure that it *is* a law. Ultimately, the law becomes for him much *more* reliable than any single observation. It now begins to stand before the scientific man, the hardest of hard facts, by no means a fabrication of his;—his exhumation rather, almost to be called a thing of power; although, even now, it might conceivably be brought to naught by a sufficient array of new observations; and, indeed, the presumption is that the time will come when it will have to be reformed, or perhaps even superseded.

V. *What was Hume's argument against miracles?*

[The argument consists of two parts. In the following analysis of it, I number the paragraphs of the first part which contains the gist of the whole. My comments are inclosed in square brackets, and each paragraph containing a condensation of one or more of Hume's is preceded by his name.]

HUME: An argument of Archbishop Tillotson against the real presence is of a very broad nature, showing decisively that no testimony whatever can prove propositions of a certain kind. ¶1.

HUME: announces that he has discovered a similar general and decisive argument against all miracles, than which nothing could be more convenient. ¶2. [The allusion here, well-understood by every contemporary reader, was to the fact that all through Hume's boyhood (he was born, 1711) and down to within four years of his present publication, the island of Great Britain had rung with the vigorous attacks of a very pious Christian, Rev. Thomas Woolston, and of his successor Peter Annet, upon the literal truth of the gospel miracles. Woolston's first publication in this line was in 1705; and from 1720 to 1728 his publications were almost incessant. He was then imprisoned,* and died in prison in 1733. But the same cudgels were taken up by Annet, another clergyman, who took pains to make himself intelligible to the common people. His attack on the resurrection reached its third edition in 1744. Hume's argument appeared in 1748. The sale of Woolston's books had been absolutely unprecedented; and they provoked no less than sixty published replies. There can, therefore, be no doubt that a very large part of Christian England was already thoroughly persuaded of the incredibility of the gospel miracles at the time Hume's argument appeared. But former methods of attack upon them had involved a minute analysis of each story. To illustrate this, I will summarize Woolston's treatment of the casting of the devils into the herd of swine. He begins by ridiculing the statement that a man with an unclean spirit was permitted to remain in a public place "night and day crying out," as well as the assertion that "no man could any more bind him, no, not with a chain; because he had been often bound with fetters and chains, and the chains had been rent asunder by him, and the fetters broken in pieces: and no man had strength to tame him." In the next place there could not have been "a great herd of swine feeding" in that public place, because for centuries the keeping of swine in any part of Palestine had been forbidden by law under severe penalties. Finally, far from proving the divine nature of Jesus, such a performance would simply have evinced a shocking disregard for the rights of property; and any jury in England would have brought in a verdict of heavy damages against him. In this fashion, it had been necessary minutely to examine every one of the gospel narratives of miracles. No reader could carry such a voluminous argument in his mind; so that all must have appreciated Hume's remark that it would be found a great convenience to be furnished with one decisive argument, not only against all gospel miracles, but against all the "prodigies to be found *in history*, sacred and profane," where he doubtless had in mind prophecies, traditions of

[32] AS: "it may fail so utterly" instead of "its failure may be so utter" which Peirce inserted in final draft.

* He was not incarcerated, but was fined, and put in the debtor's prison for not paying the fine. He "purchased the liberties," and was thus allowed to enter certain streets. [This footnote was inserted by Peirce in final draft.]

stones having fallen out of the heavens, ghost-stories, tales of cures wrought by psychical agency and the like. But it will be noted that he expressly limits the argument to history. What ought to be said to a directly experienced miracle is a question which he does incidentally touch upon; but it is aside from his main argument.]

HUME: Like events do not, indeed in every case, uniformly happen under like circumstances; yet experience will commonly show how often an occurrence of one kind is usually accompanied by an occurrence of another kind. ¶3. A wise man proportions his belief to the excess of cases in experience in which facts resembling a fact in question have been found true over the cases in which such facts have been found false. In all cases we must balance the opposite experiments. ¶4. [The remarks that "a wise man proportions his belief to the evidence," ¶4, and that he "weighs opposite experiments" or "balances opposite circumstances," ¶6, merit careful scrutiny. If belief is what a man goes upon, the first statement suggests that, if the evidence is imperfect, the wise man in question will act a little on one theory and a little on the opposite theory, which is commonly called sitting on two stools. It may, however, mean that the man reckons on being disappointed once in so many times. If that be the meaning, the expression of "weighing opposite experiments" is correct enough, but the subsequent and principal application of this, that of balancing the improbability of a witness giving false testimony against the improbability of the occurrences to which he testifies, is not only inaccurate but irremediably and radically wrong.[33] It is to be noted that Hume was not the first to apply the doctrine of chances to testimony; for that had been done by Nicolas Bernouilli, the first of that name, two years before Hume [1711–1776] was born; and general attention had been called to the matter four years before Hume's *Essay* [1748] appeared by the circumstance that a lawsuit had then been decided against Nicolas Bernouilli upon the strength of the very rule which he himself had laid down. Without speaking of the great posthumous work of Jakob Bernouilli, which gave shape to the mathematical doctrine of probabilities in 1713, which Hume probably never looked into, two important works had appeared into one or another of which Hume must have looked, but without thoroughly understanding it. These were Dean Rémond de Montfort's *Essai d'Analyse sur les Jeux de Hazard* (1708; second much improved edition, 1713) and De Moivre's *Doctrine of Chances* (1716; second altered and enlarged edition, 1738). This branch of science was just coming to maturity; and the early writers are excusable for supposing, as Laplace and Poisson did later, that it was applicable to testimony. Although Hume's notions are foggy in the extreme, they are not without value and are decidedly original in part. It is next to impossible clearly to expound ideas which are themselves far from clear.[34] But the fairest rule of exegesis will be to attach such definitions to Hume's vague terms as to bring his final application of them to testimony, (to which all that goes before is merely preparatory), as nearly into harmony with the truth as its essential falsity will permit. Guided by this rule of exegesis, I find that, in order to interpret the sentence *"a wise man proportions his belief to the evidence,"* the first necessary step is to define an "evidence," or "item of evidence" in a way which is so complicated, in its abstract statement, that it will be necessary to lead up to it by an example. Suppose, then, that it is known that into an empty urn have been placed a black ball and ten white balls. This knowledge assures us that if the balls are well stirred up and then one be drawn out, looked at, and thrown back, and this be repeated again and again, indefinitely, and if, at regular intervals, as the drawing goes on (as, for example, at the end of every 10th, 20th, 30th, etc. drawing) the ratio of *all* the white drawings to black drawings *from the beginning* be ascertained, then the only value which each ascertained ratio, as compared with the last previously ascertained ratio, will not, on the whole, depart from more often than it will approach, is the value 10:1. We commonly express this briefly by saying that "in the long run" ten white drawings will be made for every one black drawing. Such a known fact (as that ten white balls and one black ball are contained in the urn,) which assures us that under circumstances definitely related to that fact (the drawings being made as prescribed), a kind of result (the drawing of a white ball) definitely related to the same fact will occur with a definite frequency in the long run, is to be termed an "evidence," or "item of evidence." It is to be carefully noted that, in all that follows, the word "evidence" is used in this ex-

[33] The next six sentences on the history of probability were inserted by Peirce in final draft.

[34] AS: "It is plainly useless to ask what Hume meant, the fogginess of whose ideas in this place penetrates to the reader's bones."

cessively peculiar sense. The next step in the interpretation must be to define in what sense "belief" is to be understood. For that purpose, Hume must be understood to postulate that when a man holds any fact to be an "evidence" in the sense just defined a feeling is excited in his breast *upon the contemplation of any one of those possible future results* to the aggregate of which the "evidence" relates; as, for example, upon wondering whether the fifth drawing will give a white ball. To this feeling, which I might perhaps incline to call an expectation, Hume prefers to attach the name of "belief." It may be "belief" *pro* or "belief" *con*. Finally, we have to ask what sense we are to attach to the wise man's "proportioning" his belief to the evidence. I must here entreat the reader's close attention to one of the niceties of this important theory of probabilities, upon which, in Hume's view and that of the "higher critics," our whole judgment of testimony ought to turn. Nothing can be more important, to every man, than to understand clearly how far they are in the right. I am sure, therefore, that the reader will not object to being called upon for somewhat close thought, here. Suppose, then, it were known that the contents of an urn were as follows:

1 black ivory ball,	10 white ivory balls,
3 black wooden balls,	30 white wooden balls.

This knowledge would be an "evidence," in Hume's peculiar sense of the term, that if balls were drawn at random and replaced, in the long run ten white drawings would be made for every black one, and three wooden drawings for every ivory one. Furthermore, these two "evidences" would be *independent*, in the sense in which that term is used in the doctrine of probabilities. That is to say, we should have "evidence," not only that 10 white balls would be drawn to every black one, but that this would equally be true among those which produced ivory balls. We should, likewise, have "evidence" that 3 wooden balls would be drawn to every ivory one, and this, not only among all the drawings, but also among the drawings of white balls and among the drawings of black balls. This is the meaning of the term *independent* as it is used in the doctrine of probabilities. But now, suppose that we were to employ a boy to make the drawings, with instructions to look at each ball after he had drawn it, and if it were either black and wooden or both white and ivory, to show it; but if it were either black and ivory or white and wooden to throw it back into the urn without showing it. According to Hume's view and that of many mathematical writers, under this last supposition the knowledge we have of the contents of the urn, regarded as "evidence" (in the same extraordinary sense) of what the character of any one ball that the boy shows will be, is analogous to our knowledge that a witness tells the truth 3 times for every time he falsifies, but that the like of the story he tells will be false 10 times for every time that it is true, considered as bearing upon the question of whether we shall believe him or not. Three wooden balls will be drawn for every ivory [35] one, just as the witness tells 3 truths against every falsehood. Ten white balls will be drawn against a black one; just as stories like that the witness tells will be ten times false to every time they are true. Under this supposition, the correct rule of probabilities is that the odds, $\frac{3}{1}$, that the witness tells the truth, is to be multiplied by the odds, $\frac{1}{10}$, that such a story will be true, to get $\frac{3}{10}$, which is the odds (or ratio of favorable to unfavorable cases) in favor of such a story told by such a witness. Hume talks of "balancing" as though addition or subtraction were to be used instead of multiplication or division. This may have been a simple blunder on his part; but my rule of exegesis would require me to interpret him as meaning that the intensity of that feeling which he calls "belief" is proportional to the logarithm of the odds which excite it, according to an extension of Fechner's law. Hume was so gifted a psychologist that it is not quite impossible that he may have seen this.

In ¶4, Hume falls into an error which is very characteristic of the kinds of mistake which the Ockhamists frequently commit, and particularly of their conception of laws of nature. Namely, he thinks that when a man is led to expect a certain sort of result in a given case, because it is, on the whole, more conformable to the analogous instances in his past experience than the opposite result would be, those single experiential instances, or "experiments," as he calls them, can logically be "balanced" against one another, as if they were independent "evidences." But this is not so. The single instances though they may be evidences in the ordinary sense of the word are not "evidences," in the sense his argument requires. If I do not know what balls have been put into an urn, the drawing of a ball and finding it to be blue, affords me no assurance

[35] The MS reads "black" instead of "ivory," but this is obviously a slip of Peirce's pen.

that any definite proportion of future drawings (and no more) will be of blue balls. This blunder has been committed, even by great mathematicians; but nobody but Hume ever fell into the manifest absurdity of holding the single instances to be *independent* "evidences." Were that the case, a man who merely knew of a certain urn of balls that a hundred white drawings had been made from it, would, in the absence of all information in regard to the black drawings, be entitled to a definite intensity of "belief" in regard to the next drawing, and not only so, but the degree of this "belief" would remain quite unaffected by the further information that the number of black drawings that had ever been made from the urn was zero!

It must not be supposed that because a sign that anything is a fact is highly convincing, therefore that sign must be an "evidence," in the sense here required. An "evidence," in what we are bound to take as Hume's meaning, is an argument from which it *necessarily* follows that a given sort of result must happen in the long run just so often, neither more nor less. Past experience is no "evidence" of future experience, because it is quite conceivable that the arrangements of the universe should change. Nor is there any sense in speaking of "evidence" of any single event; for "evidence" only shows how often a certain *kind* of event occurs. In short, "evidence" properly relates only to a purely hypothetical state of things, which quite *other* kinds of reasons may induce us to believe approximately agrees with the real state of things.

It is proper here to explain the analogy between Hume's erroneous assumption that the single instances of an induction are *independent* "evidences," and the opinion he and his followers entertain that when an event occurs in accordance with a law of nature, there is no real "necessity" in it. I do not accuse them of saying that there is no necessity in such an occurrence in *any* sense. On the contrary, they are fond of calling themselves "necessitarians." In the strict scholastic sense, necessity, as all the old logics containing the doctrine of modals explain, is a species of universality. To say that an event is necessary, in the strict sense, means that it not only does happen, but would happen under *all* circumstances. In this sense, the Humists are not peculiar in denying that any experiential knowledge is necessary. Almost all philosophers agree to that. In the usual sense of every day life, that is necessary which would happen under all circumstances *that would ordinarily be considered*. Thus, we do not say that the alternation of day and night is necessary, because it depends upon the circumstance that the earth continually rotates. But we do say that by virtue of gravity every body near the surface of the earth *must* be continually receiving a component downward acceleration. For that will happen under all circumstances we are likely to take into account. Nor do Hume or his followers dream of denying that. But what they mean when they say there is no "necessity" in gravitation is that every "event" which gravitation formulates is in reality totally *independent* of every other; just as Hume supposes the different instances of induction to be *independent* "evidences." One stone's falling has no real connection with another's fall. The fact that the acceleration, which is what gravitation consists in, is continual, would make it necessary for such theorists to suppose time to be composed of discrete instants; and, of course, the Ockhamist doctrine that nothing really *is* but individual objects is contrary to any true continuity. The objection to Hume's conception of a Law of Nature is that it supposes the universe to be utterly unintelligible, while, in truth, the only warrant for any hypothesis must be that it renders phenomena intelligible. The Humists are very fond of representing their conception of a law of nature as a scientific result; but unfortunately metaphysics has not yet reached the scientific stage, and when it shall at length be so far matured, every indication today is that it will be a metaphysics as far as possible from this fourteenth century Ockhamism. Anybody who maintains that there is any sense (except the strict scholastic sense) in which it is a result of science that a law of nature is not necessary, may at least be required to explain very distinctly just what that sense is; and to avoid the imputation of insisting upon a truism, he will probably vouchsafe to tell us who are the philosophers of the present day with any following who hold the contrary opinion.

The treatises on probabilities, which are written exclusively in the interest of the mathematical developments, and are weak upon their logical side, treat testimonies as "evidences" to be balanced along with and against one another. That is to say they think that the character of a witness, etc. will in itself afford an absolute assurance that he will falsify just once in so often, neither more nor less. This seems to me absurd. How

often he will answer wrongly depends on how the questions are put. If they are so put as to be answered by yes or no, mere haphazard answers will, *we are told*, be half the time right; but a person who should answer correctly half the questions in such a book as *Magnall's Historical Questions*, would not have answered at random. If it be said that what is meant is the ordinary course of questions in the long run, I doubt very much whether there is any long run in such a case. This phrase implies a series of ratios converging (though irregularly) toward a definite value. There is no necessity that there should be such a convergence; and if there is not, there is no long run and no such thing as probability in the case.

Without going deeper into the discussion, I will only say that if I am right in contending that there is no such thing as the numerical "veracity" of a witness; that the idea is essentially absurd; then, whether I am right or not in maintaining that a similar remark holds good of the "credibility" of a narrative, taken in itself, Hume's argument is hopelessly wrong and past all mending. But if I am wrong in both respects, then with the proper definitions, there can be no doubt that his method of "balancing evidences" is profound and excellent, and that his argument does refute all very extraordinary histories.]

HUME: Belief in testimony is merely a case of judgment based upon the knowledge that there is a certain degree of uniformity in certain phenomena (namely the degree of uniformity with which testimony of a given character is true;) and, as such, that belief should be governed by the same principles as other reasoning from the uniformities of experience. ¶5. Testimony must, therefore, be accepted or not, according to the balance of likelihoods. ¶6. (Hume says, "balance of opposite circumstances.") We have to consider the character and number of witnesses, etc. ¶7.

HUME: When the fact testified to partakes of the extraordinary and marvellous, or is such as has seldom fallen under our observation, this should have a weight in the other scale. ¶8, a corollary supported by a Roman proverb. ¶9. Nor did the Indian think unwisely in refusing to believe in ice. ¶10. [Here, a note, interesting for its acute reference to the rule of continuity, has little relevancy to the main argument.] What ought we to conclude in case the character of the witnesses, to be put into one scale of our balance, is all that could be desired, while the extraordinariness of their story, to be put into the other scale, also reaches its maximum, in being a miracle? ¶11. A miracle is a violation of X. [A violation of "the laws of nature," says Hume. But since the problem before us is to ascertain the precise logical bearing of a particular conception of the laws of nature upon Hume's argument, we must, according to the rule of logic, substitute for that phrase a symbol, which shall render it impossible to set forth the argument without explicitly stating so much of the logical content of the suppressed phrase as has any real relevancy to the argument.] But a firm and unalterable experience has established the truth of X. Therefore, the argument against the miracle is as cogent as any argument from experience can be. A miracle is an event against which there is a uniform experience. ¶12. [This is the only definition of a miracle which is pertinent to the argument. As he elsewhere has it, a miracle is that which has not only never been known to happen in any age or country, but which is positively counter to all experience. At this point, Hume inserts a footnote to deal with the trifling objection that in many miracles the effect is not at all unparalleled; as when that effect is that an Ananias in apparent health falls dead, or that a storm immediately abates. The answer is that such circumstances are, in no case, the whole story, all of whose items together make up an unprecedented complex. In the course of this note, Hume gives the scholastic definition of a miracle in its full shape, to which I shall revert below. The whole foot-note is mere eddy in the current of the argumentation.]

HUME: It follows that in order to establish a miracle by testimony, it would be requisite to adduce testimony of such a character that its falsehood would constitute a miracle—and a miracle much greater than that to which it should testify. ¶13.

[To refute the widely spread and extremely important error, as I hold it to be, that testimony ought to be treated by the balancing of likelihoods, and to show upon what principles it ought to be treated, with a sufficiency of illustrative examples, would require a separate essay; and its connection with the conception of a law of nature is not very close. I may mention, however, among the objections to that method, that it confounds two totally different things; objective probabilities, which are statistical facts, such as form the basis of the insurance business; and subjective prob-

abilities, or likelihoods, which are nothing more than the expression of our preconceived notions. It was not "likely" that a stone would fall from the sky as long as men had a violent prejudice that it did not. But that is not all. The notion that a man tells a falsehood once in so often, *independently* of what the subject matter is, is a theory too far from the truth to be of the slightest service. Moreover, the practice of German writers on those branches of ancient history with which I am acquainted (which do not include biblical history) of frequently rejecting all the evidence there is, in favor of their notions of what is likely, without attempting to explain just how that testimony came to be what it is, is quite unwarrantable. The true method is in all cases to explain the testimony; and then, to put the explanation to every test possible. But examples would be required to show clearly what I mean.[36]]

HUME begins Part II of his argument [which is unimportant for our purpose] by enunciating the proposition which he is to prove, namely, that no testimony to a miracle ever had the requisite degree of certainty. ¶1. This is, indeed, sufficiently proved by the consideration that, with no human witnesses, could the event of their making up any story by a mixture of error and exaggeration be deemed a miraculous event, or anything approaching to miracle. ¶2.

In addition, people are more likely to tell false stories that are marvelous than false stories that have nothing remarkable about them. ¶¶3–6. Further, we are in possession of special information which increases the improbability of stories of this nature. ¶¶7–10. Further, the miracles of each religion are opposed by the miracles, and other evidences, of all other religions. ¶11. Three well-authenticated uses of miracles are adduced which any ordinary English contemporary of Hume would reject. ¶¶12–14. [They appear weakish under modern light.] Seven arguments follow (¶¶15–21) all of which are special, except the first, which is not developed. In ¶22 the argument is summed up, in full agreement with the above analysis. [The three next paragraphs, ¶¶23–25, appear to involve bad reasoning, since Hume only considers what he should say in certain cases, without showing to what conclusions his principles would lead. At all events, they are merely intended to confirm the principles employed by showing that they agree with the dicta of good sense.] Francis Bacon seems to have embraced the same principles of reasoning. 26. [The two concluding paragraphs, ¶¶27, 28, merely fling a gratuitous insult to christians, in order to give *éclat* to the chapter and to provoke angry replies.]

VI. *What is the bearing upon this argument of any particular conception of the laws of nature, or of the metaphysical essence of a miracle?*

The fathers of the church defined a miracle as a performance so far beyond ordinary human powers as to show that the agent must have had extraordinary super-human aid. This definition, which contains nothing about laws of nature or anything else, of a metaphysical character, would have suited Hume's purpose to admiration. He would have said, here we have two alternatives before us; either we have to believe that falsity has in some way crept into the testimony, or we have to believe that a man did something which all experience is against the possibility of his having done. Which is the more likely? Since experience is the only source of knowledge, we ought to accept the former alternative, which is quite conformable to experience, rather than the latter, which is altogether against it. This is Hume's argument, unmodified. It thus appears that that argument does not require any particular view to be taken of the regularities of phenomena or of the nature of a miracle,—further than that it is something opposed to all experience.

Hume did not employ the patristic definition, because that definition was no longer usual. He simply adopted the definition of Aquinas, translating *"ordo naturae"* by the phrase "laws of nature," which had been familiar in England for more than two generations.*

It, no doubt, seemed to Hume preferable to allow the current definition of a miracle to stand, rather than to perplex the main question by disputing this point. And yet, were that usual

[36] This bracketed paragraph was inserted by Peirce in final draft, after Langley had deleted the rest of part V and inserted: "In common if not correct language, a law of nature is a sequence of events where all that we observe is simply that these events do follow each other so far as our observation extends, to which we are in no way whatever entitled to say that there is any *necessity* in their so following."

* The earliest instance of its use (in the modern sense) with which I am acquainted occurs in a poem of Fulke Greville, "written in his Youth and familiar Exercise with Sir Philip Sidney," (says the title page) and printed in 1633 . . . [In this footnote, inserted by Peirce in final draft because Langley had deleted the poem with the paragraphs of AS at the end of part II, the first four lines of that poem are quoted by Peirce].

definition accepted, either in its original sense or in the sense which the Cartesians and others among Hume's contemporaries would put upon it, it ought logically to preclude the admission of Hume's argument. For it is a vital postulate of that argument that experience is absolutely the sole source of our knowledge; while by the "order of nature" the scholastic realists had understood something like thought, or reasonableness, really active in shaping the phenomena of the cosmos. But to grant that there is such an energizing reasonableness is to give some hope that the inborn light of man's reason may contribute something to knowledge. Now if any place for such hope be allowed, then in cases where experience seems to be wholly in default,[37] as (apart from the gospel narratives) it seems to be wholly in default as to what would happen if the Son of God commanded a man to rise from the dead, then we shall inevitably resort, in such cases, to that inward "light of nature," to the discomfiture of Hume's argument. It thus appears that a strictly Ockhamist conception of the world, and consequently of the laws of nature, is presupposed in Hume's argument.

VII. *What effect did Hume's argument produce upon the minds of those of Hume's contemporaries who did not publish their opinions?*[38]

The majority of such people are not affected by any reasoning apart from the authority of its author; and Hume's name carried no weight at the date of this publication. Many others would remark that Hume only offered his argument as a brief substitute for other arguments of which they had heard a great deal,—arguments which certainly demanded no *more,* perhaps less, to be conceded than Hume's. It could not have had much effect on any of those who had been sufficiently interested in the subject to read Woolston and Annet. It really only appealed to Ockhamists, very few of whom were not already dead-against miracles. As for the majority of educated men, who looked upon the church as a mere adjunct to the state, they could only regard it as a reprehensible performance.

VIII. *What bearing did those persons who did not express their opinions in print conceive that the metaphysical essence of a law of nature had upon Hume's argument?*

Everybody must have seen that to regard a regularity in phenomena as due simply to a special decree of the Almighty, which is the implication of the phrase "law" of nature, was a view eminently favorable to miracles; to such a degree, that it could, and did, lead men to argue that what would be exceedingly improbable under ordinary circumstances, might become highly probable when God wished to reveal himself. Yet no doubt there were swarms of men for whom such reasoning (which from the Ockhamistic standpoint is quite nonsensical) was far too abstruse, and who would simply say, "Although this gentleman shows his disposition to concede everything he possibly can, yet he cannot admit miracles because he is such a wonderful reasoner, whom we cannot follow. So, no doubt, he is right." Others, seeing that "laws of nature" were talked about, and well knowing that no Hobbes or other strict Ockhamist could endure such a phrase, were probably blinded by it to the fact that Hume's argument could have no standing except upon Ockhamistic ground.

IX. *Does Hume's argument affect the educated men of our day differently; and if so, why?*

I have little doubt (for here again I can only state what lies within my own narrow horizon) that the argument has lost a good deal of the *prestige* which it enjoyed at an intermediate period when philosophy was in a confused state and metaphysical questions were not as well understood as they were in Hume's time or as they are now.

Many men are now doubtful whether there is sufficient evidence that there was any one Jesus to whom the gospels mainly relate; and under those circumstances they can hardly think it worth while to examine Hume's argument. Others opine that, independently of Hume's argument, which may be questionable, miracles performed in the midst of such a mob as would seem to have surrounded Jesus, could not possibly be sufficiently attested. Very few Christians now rest their faith on the gospel miracles. They believe in the

[37] Langley's version of the remainder of part VI: "then we shall inevitably resort in such cases to that inward 'light of nature,' to the discomfiture of Hume's argument. Everybody must have seen that to regard a regularity in phenomenon as due simply to a special decree of the Almighty, which is [nearly] the implication of the phrase 'law of nature,' was a view eminently favorable to miracles; to such a degree, that it could, and did, lead men to argue that what would [usually] be exceedingly improbable might become highly probable when God wished to reveal himself. Yet no doubt there were swarms of men for whom such reasoning was too abstruse." [Words inserted in brackets were added by Peirce.]

[38] Langley's version deleted most of parts VII and VIII and incorporated the remainder of these parts in part VI, so that parts IX and X of Peirce's AS became parts VII and VIII of Langley's version.

religion because of some personal experience of their own; and if they believe in the miracles, in a literal sense, it is because they seem inseparable from the religion. Then again, Hume's main principle, that historic testimony ought to be judged by the balance of probabilities, has now been so exploited by the German critics, and carried so much further than Hume's innocence permitted his doubts to wander, that it has lost all its novelty, and most of its lustre.

In addition to these general causes, two special features of Hume's argument tend now to render it unacceptable to many. The first is his teaching that all human knowledge rests upon a quasi-mechanical examination of statistics, without allowing the smallest part to the natural light of reason, which is counter to the tendencies of thought of our day, when evolution has already caused us to recede somewhat from pure Ockhamism. Another thing is that Hume, after having made all reasoning an application of the calculus of probabilities, promptly displays such ignorance of the calculus himself [39] as to cause those who know something of it to take him to be more superficial than he really was. Anyway, we are now in the mood of dwelling on the superficiality of eighteenth-century scepticism; so that such a symptom inclines us to contempt for Hume, who was really one of the great geniuses in psychology.

X. *Has any change in the usual conception of a law of nature been influential in causing the change of attitude toward Hume's argument?*

The very same conception of a law of nature which was most widely adopted in Hume's day is certainly the one most widely adopted now. The difference is that the progress of scientific applications has now forced everybody to ponder upon the regularity of nature,[40] so that, whereas in Hume's day, as well as we can judge, a good majority of the protestant clergy not only persuaded themselves that they believed in miracles, but really did so, in our day a man may, during a long season of severe drought, make a point of going to one church after another, on different Sundays, without once hearing a prayer for rain.

I dare say people are now more given to fortune telling, chiromancy, communications from the other world, and other similar means of nervous titillation, which they class with wireless telegraphy, telephony, X-rays, and bicycles, as things incomprehensible, than they were in Hume's day, when good sense was in fashion. But I see no analogy between that state of mind and belief in miracles.

It is true that a section of the scientific world has of late been considerably occupied with the essentially provisional character of scientific theories. There is nothing new about this. St. Augustine, in connection with miracles, remarked that the unregenerate man can know nothing of the real order of nature, and that a miracle is but a violation of the laws of nature *so far as we know them;* and Bishop Butler, in Hume's day, repeated the remark.[41] But to say that the formulae we have found reason to accept as laws of nature are likely, in time, to be superseded, far from being necessarily hostile to Ockhamism, is quite in accord with that philosophy, and has, in our time, been urged chiefly by Ockhamists. Neither is there anything in Ockhamism to make miracles impossible. What *is* illogical, from the Ockhamistic standpoint, is the making of either of those propositions a ground for admitting any particular miracle. For upon Ockhamistic principles, the only logical support for any belief is positive experience, and to argue from what you do *not* know is simple nonsense.

So far as there are, in our times, evolutionary tendencies, which already begin to cause us to regard laws from a different point of view, there is the germ of ideas destined to destroy Ockhamism, and with it the argument of Hume against miracles.

XI. *What are the real merits of Hume's argument?*

It is one of the strongest applications that ever has been made of the general method of judging testimonies by balancing likelihoods.

That method rests on the assumption that experience is the sole source of knowledge, and the inductive process the only way of passing from the known to the unknown.

Not only is our knowledge not exclusively derived from experience, but every item of science came originally from conjecture, which has only been pruned down by experience.

The inductive process is inexplicable upon the assumption that all our knowledge comes from experience alone, and would be impossible if it were the only way of passing from the known to the unknown.

The entire matter of our works of solid science consists of conjectures checked by experience. The entire of matter of those works which have

[39] In final draft, Peirce added: "that very calculus of probabilities from which he makes such a parade of drawing his argument."

[40] Langley deleted the rest of this sentence.

[41] Langley deleted the rest of this paragraph.

been written upon the method of judging of testimony by balancing likelihoods consists of conjecture riding rough-shod over all the pertinent facts.

This method has never been put into practice without yielding fruit either ridiculous or horrible, according as the application was speculative [42] or practical.

It has been applied speculatively by modern German critics of ancient history, with whom it is a constant practice to deny the testimony of all the witnesses and to set down what seems likely in a German University town in the place of history. But wherever those critical denials have been struck by the spade of the archeological explorer, the attitude of criticism has made a laughable picture.[43]

The same principle has been practically applied on the continent of Europe to judicial evidence; and if anybody is shocked by the hideous wrongs perpetrated by our own courts and district-attorneys' offices, he can find some balm for his wounded Americanism in studying the results of the method in question in continental "justice."

[42] Peirce in final draft changed "speculative" to "purely scientific."

[43] Langley's version ended here, deleting the last paragraph of Peirce's AS, printed above.